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PAPERS ON COMMERCE.

THE PAULUS HOOK STEAM FERRY BOAT.

(With a Plate.)

THE danger and inconvenience of the ferry across Hudson's river, from New-York to Jersey city, has been sensibly felt by all who were necessitated to pass by that route, which is one of the most frequented from Maine to Georgia. In head winds and strong tides, it has often required three hours to make the passage, and in a calm it has been next to impossible to get over such a boat as would be able to take a horse and carriage. Even under the most favourable circumstances, the risque and inconvenience of putting a carriage and horses into a sail boat, was daily experienced, and the passage of the Hudson pressed like a load on the mind of the traveller who was under the necessity of crossing it. A bridge in this situation is rendered impracticable, in consequence of the width of the river, the depth of the water, expense of construction, and the injury which it would cause to the navigation. But, happily, a novel work of art has removed all those difficulties: Mr. Fulton has constructed a Steam Ferry Boat, the complete success of which seems to give every advantage which could be expected from a bridge, at least during the

time the river is free from ice, which in this place is usually ten and a half or eleven months in the year; and thus greatly facilitates the *commercial intercourse* between the Northern and Southern states.

The annexed engraving is a perspective view of the Boat, and the floating bridge, by which passengers, carriages, horses, &c., enter or land from her.* "She is a combination of two boats, each 10 feet beam and 80 feet long, separated 10 feet, and fastened in that position with strong beams and braces, forming a deck 80 feet long, and 30 feet wide, which breadth of beam gives stability in crossing the river through the trough of the waves. Between the two boats the water-wheel is placed, where it is guarded from all injury; and over the open space between the two boats, on strong timbers, the boiler, engine, and whole machinery are placed, which leaves 10 feet space on each side for passengers, carriages, horses, cattle, &c. One side is appropriated to carriages, horses, &c.; the other, as in figure 2d, has neat benches, and is covered with an awning for the convenience of passengers: on this side there is also a cabin, capable of containing 100 persons, where they can take shelter in boisterous or rainy weather, or from the cold of winter. There is a rudder at each end of the boat, and in a right line between the two boats; having the rudder post (which is of wrought iron) exactly in the middle, and being thus equally balanced from the centre, they can go either end foremost. The rudder, its yokes, parallel rods, &c., which carry its movements to the tillers on deck, as in figure 1st, are represented figure 3d. In this manner the boat never puts about; and thus, as carriages and horses enter at New York, their heads towards Jersey, they go out at the other end of the boat, without changing their line of direction, which is a great convenience, and saving of time. For the convenience of landing from, or entering the boat, there is a bridge, one end of which is fastened by hinges to the inner bulk head of a dock, and the other end is fastened by hinges to a coffer which floats on the water, by which

* For the drawing and following description of the boat, the editor, at his request, was favoured by the ingenious inventor.

means the bridge rises and falls with the tide, and is always exactly even with the end of the boat. The dock in which the boat enters, is 180 feet long, and 70 feet wide, giving 20 feet on each side of the boat within the dock, in which spaces there are frames of floating logs running parallel to the sides of the boat about 30 feet, and then diagonally to the extreme end of the wharves, so that if the boat hits within the 70 feet, at the end of the dock, these guiding logs leave her no other place to go to, except directly to the bridge. To prevent her striking the bridge with a shock, there are two timbers, each about 8 inches square, projecting from the coffer about 10 feet, and running on rollers; these timbers are connected by ropes, with two long vessels in the form of churns, the weight of which, when descending into the water, pushes the limbers out 10 feet, the vessels are then immersed, and full of water: when the boat arrives and strikes the timbers, they are pushed in towards the bridge, and raise the buckets full of water, which buckets, in rising out, become gradually heavier and increase resistance to the boat, until her momentum is annihilated, and she arrives at the bridge without shocks; the passengers then land, and others enter as from or on a bridge."*

This boat can carry at one time from 6 to 10 carriages, and 300 persons, and usually crosses the river, which is 1¼ miles wide, in from 14 to 19 minutes. In July last a corps of flying artillery crossed in the boat from Jersey to New York, on its way to Albany, at four trips; in the first of which it brought 4 pieces of artillery (6 pounders,) and timbers, 4 ammunition wagons, 27 horses, and 40 soldiers, besides other passengers; and since that time a much larger freight of the same kind has been taken over.

Of all the works of art, this boat approaches nearest to the convenience of a bridge, and at the place where it plies, it is superior to a bridge, as it does not impede navigation.

* This contrivance to direct the boat to the end of the bridge, is extremely ingenious, the actual operation of which will be viewed by every admirer of mechanism with great pleasure. *Editor.*

By the company's contract with the corporation of New York, the establishment is to consist of two boats, so that one may leave each side of the river every half hour. While this useful invention opens an easy communication between the citizens of New York and Philadelphia, its benefits will extend to many parts of the United States, where, either from natural difficulties, or expense, bridges are impracticable. The Susquehanna, at Havre de Grace, may be mentioned as one place where such a steam ferry boat would be highly important.

DESCRIPTION OF A CAPSTAN,

Which works without requiring the Messenger or Cable coiled round it to be ever surged. By J. Whitley Boswell, Esq. of Clifford's inn.*

SIR,

I REQUEST you will lay before the Society of Arts, &c. the model of a capstan contrived by me, which works without requiring the messenger or cable coiled round it to be ever surged, an operation necessary with common capstans, which is always attended with delay, and frequently with danger. Capstans of this kind can be made by a common shipwright, and would not be liable to be put out of order. They also would not occasion any additional friction or wear to the messenger or cable, in which particulars they would be superior to the other contrivance hitherto brought forward for the same purpose; they also would much facilitate the holding on.

The great loss of time and great trouble which always attends applications to the Navy Board, prevent my attempting to bring the matter before the public through that channel, though I have had the most unequivocal approbation of the capstan from the two gentlemen of that board best qualified to judge of it. I mention this, least it might be thought that my not applying there first

* From the Transactions of the Society of Arts, London, Vol. 26. The Gold Medal of the Society was presented to Mr. Boswell, for this communication.

was from any doubt of the goodness of the invention. If the Society should approve of the capstan, I will draw up a more minute account of it for publication.

I am, Sir,

Your very humble servant,

Hatton Garden, Oct. 29, 1806.

To C. TAYLOR, M. D. SEC. J. W. BOSWELL.

SIR,

I HAVE examined your model of a Capstan, which is calculated to prevent the surging of the messenger when heaving in the cable; it certainly possesses great merit, and the idea to me is quite new.

I am, Sir,

Your humble servant,

Somerset-place, Nov. 19, 1806.

To MR. BOSWELL. WILLIAM RULE.

SIR.

ACCORDING to your desire, I transcribe the part of the letter from Mr. Peake (Surveyor of the Navy) to me, which relates to the capstan laid before the Society.

Extract of a Letter from Henry Peake, Esq.

"With regard to your ideas on the capstan; I have tried "all I can to find some objection to it, but confess I hitherto "have been foiled, and shall more readily forward it, if it was "only to supersede a plan now creeping into the service, more "expensive, and much worse than one lately exploded."

As you and the members of the Committee have seen the letter, I imagine further attestation needless relative to it.

I request you will mention, that all friction of the revolutions of the cable (or messenger) in passing each other between the barrels of the capstan, must be effectually prevented by the whole thickness of one of the rings that passes betwixt each crossing.

I add this because one of the gentlemen of the Committee wished to be informed on this point.

I am, Sir,

Your very respectful humble servant,

J. W. BOSWELL.

Hatton Garden, Nov. 26, 1806.

To C. TAYLOR, M. D. SEC.

SIR,

IN obedience to your intimation, that a written explanation of the advantages to be obtained by the use of capstans made according to the model, which I laid before the Society for the Encouragement of Arts, &c. would be acceptable, I send the following, which I hope will make the subject sufficiently clear.

As few but mariners understand the manner in which cables are hauled aboard in large ships, it will probably render the object of my capstan more manifest, to give some account of this operation.—Cables above a certain diameter, are too inflexible to admit of being coiled round a capstan; in ships were cables of such large dimensions are necessary, a smaller cable is employed for this purpose, which is called the *messenger*, the two ends of which are made fast together so as to form an endless rope, which, as the capstan is turned about, revolves round it in unceasing succession, passing on its course to the head of the ship, and again returning to the capstan. To this returning part of the messenger, the great cable is made fast by a number of small ropes, called nippers, placed at regular intervals; these nippers are applied, as the cable enters the hawse hole, and are again removed as it approaches the capstan, after which it is lowered into the cable tier.

The messenger, or any other rope coiled round the capstan, must descend a space at every revolution, equal to the diameter of the rope or cable used; this circumstance brings the coils in a few turns to the bottom of the capstan, when it can no longer be turned round, till the coils are loosened and raised up to its other extremity, after which the motion proceeds as before. This operation of shifting the place of the coils of the messenger on the

capstan, is called *surging the messenger:* It always causes considerable delay; and when the messenger chances to slip in changing its position, which sometimes happens, no small danger is incurred by those who are employed about the capstan.

The first method that I know of, used to prevent the necessity of surging, was by placing an horizontal roller beneath the messenger, where it first entered on the capstan so supported by a frame, in which it turned on gudgeons, that the messenger in passing over it was compelled to force upwards all the coils above the capstan, as it formed a new coil.

This violent forcing of the coils upwards along the barrel of the capstan, not only adds considerably to the labour in turning the capstan, but from the great friction which the messenger must suffer in the operation, while pressed so hard against the capstan, (as it must be by the weight of the anchor and strain of the men,) could not but cause a very great wear and injury to the messenger, or other cable wound round the capstan; and that this wear must occasion an expense of no small amount, must be manifest on considering the large sums which the smallest cables used for this purpose cost.

The next method applied to prevent surging, was that for which Mr. Plucknet obtained a patent, the specification of which may be seen in the Repertory of Arts, No. 46: In this way a number of upright puppets or lifters, placed round the capstan, were made to rise in succession, as the capstan turned round by a circular inclined plane placed beneath them, over which their lower extremities moved on friction wheels, and these puppets, as they rose, forced upwards the coils of the messenger on the barrel of the capstan. This was a superior method to the first, as the operation of forcing upwards the coils, was performed more gradually by it; but still the wear of the messenger from the lateral friction in rising against the whelps of the capstan remain undiminished.

The third method used for the same purpose, was that proposed by captain Hamilton. It consisted in giving the capstan a conical shape, with an angle so obtuse, that the strain of the mes-

senger forced the coils to ascend along the sloped sides of the barrel. The roller first mentioned was sometimes used with this capstan, of which a full account is inserted in the Repertory of Arts, vol. 2. The lateral friction, and wear of the messenger against the whelps of the capstan, is equally great in this method as in the others; and it, besides, has the inconvenience of causing the coils to become loose as they ascend; for as the upper part of the barrel is near a third less in diameter than the lower part, the round of the messenger that tightly embraced the lower part, must exceed the circumference of the upper extremity in the same proportion.

In the method of preventing the necessity of surging, which the model I have had the honour of laying before the society represents, none of the lateral friction of the messenger or cable against the whelps of the capstan, (which all the other methods of effecting the same purpose before-mentioned labour under,) can possibly take place, and of course the wear of the messenger occasioned thereby will be entirely avoided in it, while it performs its purpose more smoothly, equally, and with a less moving power than any of them.

My method of preventing the necessity of surging consists in the simple addition of a second smaller barrel or capstan of less dimensions to the large one; beside which, it is to be placed in a similar manner, and which need not in general exceed the size of an half-barrel cask: The coils of the messenger are to be passed alternately round the large capstan and this small barrel, but with their direction reversed on the different barrels, so that they may cross each other in the interval between the barrels, in order that they may have the more extensive contact with, and better gripe on each barrel. To keep the coils distinct, and prevent their touching each other in passing from one barrel to the other, projecting rings are fastened round each barrel, at a distance from each other, equal to about two diameters of the messenger and the thickness of the ring. Those rings should be so fixed on the two barrels, that those on one barrel should be exactly opposite the middle of the intervals between those on the other

barrel: and this is the only circumstance which requires any particular attention in the construction of this capstan. The rings should project about as much as the cable or messenger from the barrels, which may be formed with whelps, and in every other respect, not before-mentioned, in the usual manner for capstan barrels, only that I would recommend the whelps to be formed without any inclination inwards at the top, but to stand upright all round, so as to form the body of the capstan in the shape of a polygonal prism, if the intervals between the whelps are filled up, in order that the coils may have equal tension at the top, and at the bottom of the barrels, and that the defect which conical barrels cause in this respect may be avoided.

The small barrel should be furnished with falling palls as well as the large ones; a fixed iron spindle ascending from the deck will be the best for it, as it will take up less room. This spindle may be secured below the deck, so as to bear any strain, as the small barrel need not be much above half the height of the large barrel; the capstan bars can easily pass over it in heaving round, when it is thought fit to use capstan bars on the same deck with the small barrel. As two turns of the messenger round both barrels will be at least equivalent to three turns round the common capstan, it will hardly ever be necessary to use more than four turns round the two barrels.

The circumstance which prevents the lateral friction of the messenger in my double capstan, is, that in it each coil is kept distinct from the rest, and must pass on to the second barrel, before it can gain the next elevation on the first, by which no one coil can have any influence in raising or depressing another; and what each separate coil descends in a single revolution, it regains as much as is necessary in its passage between the barrels, where in the air, and free from all contact with any part of the apparatus, it attains an higher elevation without a possibility of friction or wear.

I have described my double capstan, as it is to be used in large vessels, where messengers are necessary, from the great size of the cables; but it is obvious that it is equally applicable in smaller

vessels, as their cables can be managed with it in the same manner as is directed for the messenger. The same principle may also be easily applied to windlasses, by having a small horizontal barrel placed parallel to the body of the windlass, and having both fitted with rings, in the same way as the capstan already described. The proper place for the small horizontal barrel is forward, just before the windlass, and as much below its level as circumstances will admit; it should be furnished with catch-palls as well as the windlass.

Besides the advantages already stated, my proposed improvement to the capstan has others of considerable utility. Its construction is so very simple, that it is no more liable to derangement or injury than the capstan itself. Its cost can be but small, and every part of it can be made by a common ship carpenter, and be repaired by him at sea if damaged by shot. It will take up but little room, only that of an half-barrel cask; and it is of a nature so analogous to that kind of machinery to which sailors are accustomed, that it can be readily understood and managed by them.

In order to render the description of my double capstan more clear, I annex a sketch of it, as fitted up in the manner proposed.

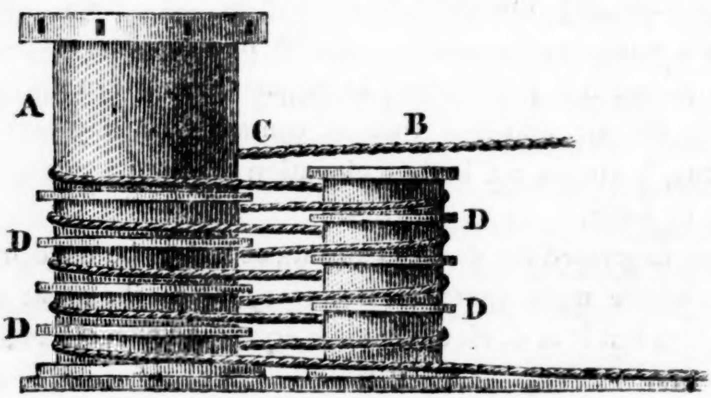
I am, Sir,

Your very respectful humble servant,

J. WHITLEY BOSWELL.

To C. Taylor, M. D. Sec.

Reference to the Cut of Mr. Boswell's improved Capstan, to prevent the necessity of surging.



A Represents the larger or common capstan used on board ships.

B Another capstan of less dimensions, placed in a similar manner.

C The coils of the messenger passing alternately round the large and small capstans, but with their direction reversed on the different barrels, so that they may cross each other in the interval between them.

D D D D Projecting rings round each capstan or barrel, so fixed on the two barrels, that those on one barrel should be exactly opposite the middle of the intervals between those on the other barrel.

ACCOUNT OF THE MEANS

Which have been used with success, in obviating the effects of

HUNGER, COLD, AND THIRST, AT SEA.

The following observations constitute part of an introduction to a very interesting Narrative of the hardships which Mr. David Woodard, and four seamen suffered, while in a boat at sea.*

THE conclusions to be drawn from this narrative and collection, and from all voyages connected with this subject, are interesting and important to society, and form, as it were, a NEW ERA in navigation, in cases of dangers and disasters. No history can be more interesting and instructing to man, than that of man, and the events that befall him. A creature of every passion, and of every clime, the events of his life produce the strongest contrasts of light and shade, which are for ever varying, and for ever new. Prosperity and adversity, hope and despair, often form the great leading features of his life; and nothing but perseverance, and a well-grounded trust in Providence, can preserve him through all his difficulties and dangers. In no situation have the shades, or the hopes, enterprises, and the objects of life, been

* The narrative was published by Mr. Wm. Vaughan, London, 1806.

more varigated or chequered than in voyages of discovery, colonisation, and commerce; and the histories of those men who have escaped shipwrecks and hardships have ever been read with the greatest compassion and the most lively interest, from the dangers that have been encountered, and the perseverance, forbearance, and substitutes, which have been dictated by necessity. The school of adversity has often called forth all the powers and faculties of the mind and body of man through fatigue and hunger, and all the storms and shipwrecks that await him; and he at last survives them, and reaches his native shore, to relate those adventures that prove the wisest lessons and consolations to his own mind, and the strongest examples for conduct to others.

Misfortunes, if rightly applied, may prove useful sources of knowledge. The respective narratives of captains Inglefield, Bligh, and Wilson, cannot be read without emotion and instruction, because they relate to events that reach men's homes and bosoms; and, in proportion as commerce expands upon an extensive scale, and forms one of the greatest links to civilisation, and has a tendency to increase the union of nation to nation, accidents and escapes are worth recording, from the knowledge they convey, and the examples they produce.

They plainly show, that hope, perseverance, and subordination, should form the seamen's great *creed* and *duty;* as they tend to banish despair, encourage confidence, and *secure* preservation.

The examples of the conduct of men sustaining hunger, thirst, and fatigue, for a length of time, almost without food, beyond its taste, or on the division of a biscuit and a glass of water, or of spirits, have frequently, under given circumstances, produced miraculous escapes; whereas despondency, insobriety, and insubordination—qualities that canker hope and induce vexation —have often proved the seeds or secret springs of mutiny and disaster; and occasioned the loss of lives and of ships, under circumstances the most calamitous and the most afflicting.

As the great fact of the powers of ABSTINENCE for a length of time, both at sea and on shore, is so fully established in the annexed documents, the next consideration is to endeavour to regulate a little the conduct of men in such trying situations.

In moments of difficulty and danger, where the remedies at command are few, patience and perseverance are necessary; and, under them, men of vigorous minds frequently overcome the greatest obstacles. It is not always possible to prescribe rules of conduct in cases that must, in general, form their own rules; but a great deal may be done by management and good conduct, to alleviate sufferings and distresses.

As there is a strong affinity between the powers of the mind and body to support each other under great conflicts, officers and men should so temper obedience and command, as to create confidence and union in each other for self-preservation. In these moments, when the impressions of religious feelings are always the strongest, their sensations should be encouraged, from the tranquility of mind and consolations they produce, the hopes they encourage, and the exertions they create.

Another object is the great importance of temperance, of union and subordination, and the keeping together without separation. The want of these has frequently been as fatal and destructive in its consequences, as the want of food itself.

The conduct of the crew of the Pandora after their shipwreck, on their returning home with some of the mutineers of the Bounty sloop, on board of four boats, until their arrival at the island of Timor; and the narratives of captains Inglefield, Bligh, Wilson, and others, are strong exemplifications of the good effects of union and perseverance; and form fine contrasts with the fate of the crew of the Wager, captain Cheap, one of commodore Anson's fleet, lost in the South Seas in the year 1740,* as collected from the four different accounts of the several routes which her men took, and the few that ever reached England; and affording a melancholy proof of the effects of that inebriety, insubordination, and spirit of mutiny, which prevailed amongst them, and which

* Wrecked on an uninhabited island. Eighty-one persons embarked in the long Boat: of whom thirty arrived in four months at Rio la Grande, after many deaths and great hardships.

occasioned most of the disasters and hardships they encountered.*

I have heard captain Wilson relate, that when his ship was wrecked off the Pelew Islands, he greatly owed his preservation, the facility of building his vessel, and the good understanding that existed with the natives, to the staving of his spirits, the good order and discipline of his men, and to their residence on an island by themselves without much intercourse with the natives of Pelew, unless by occasional direct visits between captain Wilson and officers and the chiefs of these islands.

Advantages might be derived from a proper attention to the *management of clothing*, and the keeping the body as much as circumstances will permit in an equal state of warmth, so as to suffer as little as possible from the transitions or fluctuations of wet, cold, and air. It has been also found that warmth of clothing has frequently had a happy tendency to lessen the sensations of hunger, and to prevent colds and disorders incident to checked perspiration. Where there has been a scantiness of clothing, warmth has been often produced by keeping clothes tight round the body; and also by tying a handkerchief, or linen, round it, after the Indian fashion. Men, by rubbing themselves and each other when wet, cold, or benumbed, have often produced warmth and an increased circulation, when the body has been reduced to a languid state.

Captain Kennedy's narrative of himself and his crew, and of his subsequent distresses in an open boat for fourteen days, is peculiarly interesting, and written by a man of great intelligence and observation. He expressly states, that he and his men derived great advantage from soaking their clothes twice a-day in salt water, putting them on without wringing them; and that he imputed the preservation of his own life, and the lives of six others who survived their hardships of hunger, thirst, and cold,

* It was in consequence of the misconduct of the crew of this ship, and the conception that on the loss of a ship in the navy, all power and controul on such occasions ceased, a bill passed through parliament to put officers and men in the navy under the mutiny act.

to this precaution; and that he took the hint from a treatise of Dr. Lind's, which, he says, should be read by all sea-faring men. He also remarks, that four out of the six, who drank large quantities of salt water, grew delirious, and died; but that those who avoided it had no such symptoms.

Captain Bligh and others have also practised and strongly recommended, the same system of wringing their clothes out when wet with rain, and the dipping them in salt water; and state that they felt a benefit and change more like that of dry clothes, from its producing a refreshing warmth, than could have been imagined.

Men, particularly when in boats, are often exposed to be wet through from waves and the spray of the sea; but this inconvenience, when compared with greater evils or misfortunes, may not be without its consolations or advantages, as it is observed that men suffer less when seated in salt water, than when more elevated, and exposed to rain and to chilling winds. A blanket or a bit of a sail at their backs, the same over their knees, will often give great shelter to men, from cold, or the draughts of wind, when wet through.

If seamen on boat duty, and on night excursions, or on escaping from shipwrecks, were to wear flannel next to their skin, or were to put on double clothing, or two or three shirts, they would find a benefit and great warmth: and in case of separation from ships, or in shipwrecks, still greater advantages might be derived from this measure in moments of necessity, from their increasing their comforts, and furnishing the means, perhaps, of giving sails in moments of distress.*

The bailing of water out of boats will also tend to give em-

* When captain Woodard was questioned in what manner a boat should be equipped on quitting her ship at sea, he stated, that he should, to guard against accidents, recommend her having a compass, glass, boat-hook, and axe; a hammer, nails, tinder and box, knives, and a boiler or kettle; a gun, fishing-tackle, rope, and spare sail; their biscuits and water to be in kegs; some tobacco, money, and a bottle or two of brandy or rum: a boat-cloak, and, if convenient, a spare plank. That with these a boat's crew would survive many a storm and much distress.

ployment to mind and body, as well as warmth from exercise. Relief may be found from chewing or smoking tobacco, both as to warmth, and as a substitute to lessen the sensations of hunger. Seamen being so habituated to this article, it would be found peculiarly advantageous were it to form a part of their little stock on these occasions.

It has been generally observed, that the cold from fresh water is more difficult to be supported than from sea water; and doctor Currie, a physician of considerable practice at Liverpool, in a work on the application of warm and cold water as a remedy in fevers, confirms this leading fact.

He speaks, also, of a remarkable case of the shipwreck of an American vessel, near Liverpool, on the 13th of December 1790, where two of the crew, out of fourteen, died from the external and alternate exposure of air and water, both salt and fresh; that others, who were more plunged in the sea, survived, one excepted, who died, at a later period, of despondency. The one who suffered the least was a black, who was covered to the shoulders in the sea. The temperature of the sea was 35°, and that of the air still lower; and attended during part of the time with sleet, snow, and a piercing wind, which might have affected the men more than salt water. The stay on the wreck was twenty-three hours. The two who died first were delirious: none were drowsy; but all were thirsty and hungry. Mr. Amyat the mate, who related the story, had his hands and feet swelled and benumbed: but he was not senseless; his mouth was parched, and he felt a tightness at the pit of his stomach, with distressing cramps on his sides and hips. The conclusion drawn by doctor Currie* was, that pure water on the surface of the body was more hurtful than that of sea water. This induced him to make some experiments on the effects of immersion in fresh and in

* Doctor Currie's valuable book on fevers first appeared in the year 1798. It has been reprinted, in two volumes, with very considerable additions, and is well worthy the attention of medical and of nautical men; proving the great benefits that have been derived, in many countries, by the experiments that have been made on this subject.

salt water, of an equal temperature, on the animal heat, or on the capacities of bodies to preserve the same degree of heat under different circumstances. He has also found that bathing, or throwing salt water over the body at sea; and salt water, or fresh water saturated with salt, on shore; have frequently in many fevers reduced their virulence, when they have not yielded to medicine.

I believe, in the case of the Apollo frigate, lost off the coast of Portugal on the 2d of April 1804, this fact was unfortunately confirmed, on a more extensive scale than in the preceding instance of the ship at Liverpool; it being found that numbers perished who were exposed to the alternate effects of rain and air; and that many survived who were covered or more immersed in salt water.

Sleep should be encouraged, as one of the greatest restoratives of nature, and from its being essentially necessary for the daily preservation of health and spirits. Nothing exhausts the human frame so much as the want of it; particularly when worn down with fatigue, hunger, and distress.

Intenseness of thought, and great agitation of mind, produce restlessness, watchfulness, and despondency; and, if too much indulged, or of too long continuance, are followed by fevers and deliriums that end frequently with the most fatal consequences. Nothing can be more destructive to life, or to perseverance, than permitting the depression of the mind or spirits.

Captain Fellowes, in his interesting narrative of the loss of the Lady Hobart packet, states naturally* the effects of despondency and delirium in the case of a poor French captain, who, in the height of his disorder, threw himself overboard, and instantly went to the bottom;—that the boat's company were all deeply affected by a circumstance that was sufficient to render their irri-

* The Lady Hobart was wrecked in June 1803, lat. 46, 33, long. 44°, being then 350 leagues from Newfoundland, by striking against an island of ice. Nineteen persons took to the cutter, and eleven to the jolly boat: in seven days they reached Island cove, Conception bay.—See Domestic Encyclopædia, article Thermometer.

table state more painful;—that he himself was seized with such melancholy, as to lose all recollection of his situation for many hours;—that it was accompanied with violent shiverings, which returned at intervals; and with a refusal of all sustenance, that made his state very alarming. Towards night he enjoyed, for the first time during six days, three or four hours' sound sleep; and perspiration coming on, he awoke as from a dream, free from delirium, though alive to the horrors of their situation. Sleeping, however, in the sun, or being exposed to nightly dews, should be avoided as much as circumstances will permit. It should also be remarked, that a change of climate or of seasons may render this recommendation advisable under given restrictions, as doctor Solander and others have cautioned seamen against sleep, when exposed to extremely cold situations; as, under those cases, it generally ends with sleeping to rise no more.

The effects of *hunger and thirst* are greatly overcome, when the *apprehensions* about them are banished: and we find that captains Inglefield, Bligh, and Woodard, always discouraged despondency; and by giving other pursuits to the human mind, men were frequently diverted from gloomy objects; and when thus roused, they have often been strong enough to surmount the greatest difficulties. We often see men with courage braving danger in battles and enterprises, and risking life to save a life or a wreck; but when self-wrecked, until roused, they are often apt to shrink into despondency, from the want of labour and self-exertion.

It frequently happens, that, after the first panic and exertions in cases of shipwrecks are over, there is then but little expenditure of strength; that smooth sailing saves labour; and, from the want of great bodily exertions, the calls for subsistence considerably lessen. By habit, the body may also be brought to do with less and less sleep; and the same also may be found of food, both as to *quantum* and *quality;* and in this little collection, and in numberless voyages, there are the strongest proofs of how small a quantity of either will sustain the lamp of life for a long period.

Thirst appears to be of a more distressing nature than hunger; but various instances are produced to show how much it has, and may be allayed, only by the preservation of moisture in the mouth, when there has been no other means of satisfying the pressing calls of nature; as a tea-spoonful of water, wine, or spirits, in the cases of an Inglefield, Bligh, and others—or even drops of perspiration from the human body, as in the case of Mr. Holwell while in the Black Hole of Calcutta—have for a length of time satisfied those calls, so as to secure the preservation of life. The moistening of the mouth alone, or the rinsing of it with any liquid, or even with salt water without swallowing any of it, have in many cases been found to produce the most salutary effects; and it may have fallen frequently within the observation of many men, when exhausted or heated in very warm weather, to have complained greatly of thirst, but who have not been able to quench it by great draughts of liquid. The sensations of it have continued until the body itself has been restored to its natural tone, or until moisture has been produced in the mouth to allay it.

Innumerable instances might be produced of shipwrecks and accidents that confirm these facts; and also cases of ships being lost, or locked up in ice in the North Seas and Hudson's Bay, where men of different nations have been hutted for months under ground, to guard against the inclemency of frost and snow, who have survived every hardship from want of food, fuel, and water; and also where men and animals have been buried in snow, or fallen into pits, mines, caverns, and other places, who have been miraculously preserved for a length of time without sustenance, or, if any, on the slightest pittance possible, and that frequently more from a little moisture than from food.*

Seamen have also great encouragement given to them from other considerations:—when they see that others, by having braved the greatest hardships and severities, frequently find a

* The same may be said of light. When men fall into pits and caverns, their eyes, as well as their habits, soon adapt themselves to the greatest changes and powers of contraction, and to their situations.

strength added to those claims which merit, bravery, and other services, have entitled them to from their country; and that many have lived to enjoy promotions and situations in life honourable and respectable, which they never would have enjoyed had they abandoned themselves to despondency and despair. In private life we have seen a Woodard fortunate enough to command the very ship in which he had been a mate before his misfortunes;—a Wilson, after the loss of his ship, and friendly reception at the Pelew Islands, returning home and commanding the Warley, one of the largest class of ships in the India Company's service;—and a Fellowes meriting every attention from the port-masters-general:—while in the navy an Inglefield is a living testimony of his own miraculous escape, and enjoying the reward of gallant and meritorious services in the appointment of a commissioner in the navy, at Gibraltar, during the last war, and now filling the same honourable situation as commissioner at Halifax;—a Riou lived to command the Amazon off Copenhagen, where he lost his life; and his country is now raising a public monument to his memory;—and a Boys, from a midshipman, lived to be elevated to the situation of lieutenant-governor of Greenwich Hospital.

In closing these observations, I beg to remark, that they have been submitted rather as general hints or outlines to be improved upon, than presented as a system of conduct applicable to all situations, climates, and seasons. A change of circumstances will occasion great varieties and exertions which the powers and resources of the moment must dictate. My object has been to encourage hope, confidence, and perseverance in trying situations, from the examples and conduct of others, as some of the best means of self-preservation.

Dr. Lind's advice to prevent the want of provisions at sea.

Dr. Lind, in his Treatise to prevent the Want of Provisions at Sea, states, that two pounds of salep, and the same of portable soup,* will afford a wholesome diet to one person for a month;

* Salep is powdered orchis root. Flour of sweet potatoes, or of the common potatoe; or the latter root, sliced and thoroughly baked, would answer as

and recommends every ship to carry a quantity of these articles to sea, as they would be found extremely beneficial when, through fire, shipwreck, or other accidents, the crew were obliged to have recourse to their boat.

He supposes, were a boat furnished with eleven gallons of water, two pounds of salep, and two pounds of portable beef soup, for each man, that it is probable none would die of hunger, or thirst, for at least a month; during which time the daily allowance per man would be more than a quart of water, eleven ounces of strong salep paste, and an ounce of portable soup.

The soup should be allowed to melt in the mouth; and in that small quantity, if properly made, would be contained the nourishing juices of above three-quarters of a pound of beef. In cases of great extremity the salep might be mixed with salt water, and be still equally wholesome. The salep sells for about four shillings and six-pence per pound, and the portable soup at two shillings and six-pence per pound.

As a careful precaution, he recommends ships to have constantly a cask of water in the boat, or upon deck; and the same precaution respecting the salep and soup being at hand in case of fire, or other accidents at sea, when it might not be possible to go down into the hold for water or provisions.—*Dr. Lind on Hot Climates.*

well, and be much cheaper, and more easily procured than salep. Portable soup is made by slowly boiling down the gelatinous parts of beef, mutton, veal, and pork, with aromatic vegetables, and pouring the mass into chocolate moulds: it will then become solid, and may be dissolved in water as wanted. *Editor.*

ON THE PRESERVATION OF SHIPS

BY THE USE OF COMMON SALT.

THE practice of salting sea vessels with a view to their preservation, has long been followed in the port of Philadelphia, and found highly beneficial. The following is the mode adopted:

Pieces of boards are dove-tailed between the timbers and to the outside planks about the floor timber heads: also a little above the listings in the hold, and lastly above the listings between decks. After the vessel has been watered in order to discover leaks, the water drained off, and the timbers are prepared for ceiling, let all the spaces between the timbers and the outside and inside planks be filled with salt, and drove down. The upper rooms must of course be filled before the plank shares are put on. The spaces between the transoms must also be filled.

Salt is only used in vessels built of unseasoned timber, and two of the most experienced ship builders in Philadelphia, gave it as their opinion to the Editor, that a ship built of timber fresh cut and salted as above directed, would far outlast a ship built of the most seasoned timber. The names of several ships built in Philadelphia in 1790, 1792, and since, of unseasoned timber, and salted, were mentioned as being sound to this day.

The effect of the salt is thoroughly to penetrate the planks and timbers, as was evident from a thick incrustation of the salt on the lining of the cabbin of a ship thus salted. This lining was five inches thick and painted. The impregnation of the timbers and planks, will of course cause considerable waste of the salt, and will require a renewal of it after every voyage. One ship, (the Coromandel), built in 1806, of 349 tons, required 575 bushels of salt on the stocks; 300 bushels on her return from Calcutta in about 18 months after she was built; and 250 bushels since. The ship Benjamin Franklin, built in 1795, and of about 263 tons, required 350 bushels. The ship Ploughboy, of 287 tons, built in 1800, took 316 bushels. Vessels even of the same tonnage will require more or less salt, as the spaces between the timbers are greater or less.

PAPERS ON MANUFACTURES.

ON THE MANUFACTURE OF ALUM.

ALUM, improperly denominated Sulphat of Alumine, in the modern nomenclature, is by far the most important of all those with earthy bases.

There are several varieties of salts, composed wholly, or for the most part of sulphuric acid and alumine, clearly distinguishable from each other, though generally confounded together under the vague name of alum.

1. The first is sulphat of alumine, being a saturated combination of alumine and sulphuric acid.

2. The second is acid sulphat of alumine, and differs from the preceding only in containing an excess of acid.

3. The third is acid sulphat of alumine with potash, crystallizing in octohedrons.

4. The fourth is acidulous sulphat of alumine with potash, crystallizing in cubes.

5. The fifth is sulphat of alumine with potash, or alum neutralized by its own earth, pulverulent, insipid, insoluble in water.

6. The sixth is acid sulphat of alumine with ammonia.

7. The seventh is acid sulphat of alumine with potash and ammonia, or the *common alum of the shops*.

The simplest process by which alum is prepared, is that in use at the Solfatara, near Naples. The Solfatara is a small plain on the top of a hill, covered with a white soil, in which are numerous round holes or craters, from which sulphureous vapours constantly ascend, and impregnating the soil, form a rich ore of alum, from which the alum of the shops is prepared by boiling and crystallization.

The alum works of La Tolfa, near Civita Vecchia, in the Roman State, are among the oldest in Europe, and the alum made there is the finest of any. The ore made use of, is the *Alaustein* of the Germans, or alum stone, of a grayish or yellowish white, or light yellowish or smoak-gray; and found in considerable masses, and so hard as to require blasting by gunpowder.

Alum is also made from pyrito-aluminous ores.

The only manufacture of alum conducted upon strict chemical principles, is that established by Chaptal some years ago, near Paris; by the direct union of sulphuric acid and pure clay, and producing alum only inferior to that of La Tolfa. These two last processes are fully described in Aikin's Chemical Dictionary. Chaptal's process was originally published in the Annals of Chemistry of Paris, Vol. 3.*

By far the greater part of the European alum is prepared from the aluminous slate or the aluminous earth:† and this process shall now be given.

The process practised in the manufactory of Alum, near Whitby, Yorkshire, by Richard Winter.‡

"The aluminous schistus is generally found disposed in horizontal laminæ. Sometimes it exists in the form and appearance of indurated clay; in fact the whole of the upper part of the stratum resembles indurated clay, when first wrought; but by exposure to the atmosphere it suffers decomposition, and crumbles into thin layers. The upper part of the rock is the most abundant in sulphur, and the deeper they work into it, the quantity of sulphur decreases, and the bituminous substance increases, and the rock becomes more hard and slaty; so that a cubic yard of rock, taken from the top of the stratum, is as valuable as 5 cubic yards taken at the depth of 100 feet.

When a quantity of the schistus is laid in a heap, moistened with sea water, it will take fire spontaneously, and will continue to burn until the whole of the combustible materials are exhausted.

The colour of the aluminous schistus is a bluish gray. Its hardness differs; at the top part of the strata it may be crumbled

* It is also published in the Repertory of Arts. *Editor.*

† The foregoing account of Alum is collected from Aikin's Chemical Dictionary. *Editor.*

‡ From Nicholson's Philosophical Journal, Vol. 25, (April, 1810.)

in pieces between the fingers, at a considerable depth it becomes as hard as roof slate. The specific gravity is about 2.48, it contains silex, alumine, magnesia, lime, oxide of iron, bitumen, sulphur, and water.

Of the Calcination and Lixiviation of the Schistus

The covering strata are removed previous to working the alum rock (as it is generally called). The hewing of the rock is performed with picks and javelins; and it is conveyed to the calcining place in barrows, so contrived, that the centre of gravity of the weight, is in a perpendicular line passing through the centre of the axle of the wheel; by this means the men have nothing more to do, than to keep the barrow steady, throw the weight of the substance upon the wheel, by raising the handles, and direct the barrow upon the way, which is formed of cast iron plates, 6 feet in length, 6 inches in breadth, and half an inch thick; these plates are fastened into cross pieces of wood fixed into the ground, at the end of each plate. Ten of these barrrows contain one solid yard of the rock. The expenses of working the rock vary according to the facility with which it can be hewn. When the distance the rock is to be barrowed is about 200 yards, the rate for removing and hewing one cubic yard is about 6½d. It is unnecessary to state, that the price must maintain a corresponding ratio with the distance to be conveyed. The men earn about 2s. 6d. per day in the winter season, and 3s. in the summer.

The rock is poured out of the barrows upon a bed of fuel, composed of underwood, furze, &c. The dimensions of this pile of faggots is about four or five yards in breadth, and two in height; as the rock is deposited upon the fuel, it is necessary that it should be broken into small fragments, that the combustion may take place with the greater facility. When they have got about four feet in height of the rock upon the faggots, fire is set to the bottom, and fresh rock continually poured upon the pile; other piles of wood are then placed alongside of the first, and they proceed as before, adding more rock, firing the fuel, &c. This they continue, until the calcined heap is raised to the height of 90 or

100 feet, and from 150 to 200 feet in length and breadth. Some of these heaps of calcined mine (as it is now called) will contain 100,000 solid yards of schistus or rock.

When the whole heap is in a state of combustion, a considerable quantity of sulphureous acid gas is disengaged; this they endeavour to prevent, by moistening small schistus, and forming a kind of clay; with this they plaster the outside of the heap; this however does not prevent the escape of the gas in any degree, but it prevents the wind from penetrating, and assists in preventing the calcined mine from falling, by forming a kind of crust all over the heap; this crust is soon decomposed by the action of rain, &c.

The form of the places for calcining the rock in, is badly calculated to prevent the escape of the sulphureous acid gas. If the combustion was effected in a building of the shape of a smelting furnace, immediately upon the whole of the rock becoming ignited the opening might be closed, and the gas preserved. I have ascertained by experiment, that nearly one half of the sulphureous acid gas is expelled by a red heat, continued for a considerable space of time.

The sulphureous acid gas, by absorbing oxigen from the atmosphere, is converted into sulphuric acid; this change is effected by means of the oxide of iron contained in the mine, and moisture. It would certainly be worth ascertaining by experiment, whether the oxide of iron combined with sulphur in burning would not yield sulphuric acid if moistened with water.

I am aware that iron has a greater affinity for oxigen than sulphur has in the fire, but in the great scale of nature she observes laws peculiar to herself: the affinities observed in the salts of the ocean are contrary to the order they appear in our tables; here, we find the small portion of sulphuric acid united to the lime; instead of forming a union with the soda, as might be inferred. Lime is found to decompose the muriate of soda. These, and other anomalies might be produced, but they are foreign to the purpose.

130 tons of calcined mine will produce 1 ton of alum. I have

deduced this number from an average of 150,000 tons of calcined mine consumed.

The calcined mine is steeped in water, contained in pits, that usually hold about 60 cubic yards. The water thus impregnated with sulphate of alumine, called alum liquor, is drawn off into cisterns, and afterward pumped up again upon fresh calcined mine. This is repeated until the liquor becomes concentrated to the specific gravity of 1.15; or 12 pennyweights of the alum maker's weight. The half exhausted mine is then covered with water, successively, to take up the whole of the sulphate of alumine; these liquors, thus impregnated, are denominated strong liquor, seconds, and thirds.

The strong liquor is drawn off into cisterns, to deposit the sulphate of lime, iron, and earth suspended in it. In order to free the liquor from these substances, they clarify it by boiling for a short time, which enables the sulphuric acid to exert its affinities with greater energy. After running it from the pans, and suffering it to cool, the whole of the sulphate of lime, iron, superfluous alumine, and earth, are deposited; and the alum liquor is nearly pure. Where this precaution is used, the alum is much better in quality, and almost entirely divested of the sulphate of iron. This method is only practised at some of the works, owing to the additional quantity of fuel required, and consequently increased expense.

The liquor in this state is carried by means of pipes, or wooden gutters, into leaden pans. These pans are made of sheet lead (cast by the workmen in the alum house) 10 feet long, 4 feet 9 inches wide, 2 feet 2 inches deep at the hinder part, and 2 feet 8 inches at the front end: this difference is allowed to give a rapid current in running off.

A quantity of mothers is pumped into the pans every morning; and, as this evaporates, the deficiency is supplied with fresh alum liquor, every two hours, or, as the liquor in the pans becomes more concentrated, the additions are made more frequently. It is necessary to keep the pans continually boiling, otherwise the superfluous alumine and sulphate of alumine, deprived

of its water of crystallization, would be precipitated, and the pans melted, from the crust formed between the liquid and the lead.

Each pan will produce upon an average 4 cwt. of alum daily, and the consumption of coals will be about 18 bushels Winchester measure.

The liquid contained in the whole of the pans is run off every morning into a vessel called a settler, at the same time a quantity of alkaline lee is brought along with the boiling liquor, prepared either from kelp, soapers lees, (generally called black ashes) or muriate of potash, of a specific gravity from 1·037, to 1·075. The alum maker having previously ascertained the specific gravity of the liquid in his pans, estimates the quantity of alkaline lees to be added, necessary to reduce the liquor from the pans from the specific gravity of sometimes 1·45 or 1·5 to 1·35.

The liquor then stands in the settler about two hours, that it may deposit the sediment it may contain, when it is run off into the vessel (or coolers) to crystallize.

If the alum maker should be below, or equal to the specific gravity of 1·35, in mixing the alkaline lee and liquor, there is nothing more to be done. If he exceed this specific gravity, he then adds urine in the coolers, until the liquid is reduced to 1·35. It is then agitated to combine the heavy and light liquids, and then left to crystallize. It must be observed, that at a greater specific gravity than about 1·35, the liquor, instead of crystallizing, would present us with a solid magma resembling grease.

After standing four days, the mothers are drained off, to be pumped into the pans again the succeeding day. The crystals of alum are conveyed into a tub, where they are washed in water, and put into a bin, with holes in the bottom, to allow of the water draining off from the alum. They are then removed into a pan (twice as large as the common leaden pans), and as much water added as is found requisite to dissolve the whole of the alum when in a boiling state; the moment this is effected, the saturated boiling solution is run off into casks. These casks should stand about 16 days; as they require this time to become perfectly cool, in the summer season. The casks are then taken

to pieces, and a hollow cask of alum is produced; it is then broke into, and the whole of the saturated solution of alum (called tun water) is removed back into the pans, to go through the process anew.

This last process is called roching. The outside of the cask of alum is now to be cleared from dirt, and the sediment which is deposited at the bottom. It is then broken up into masses ready for the market.

Practical observations and remarks upon the foregoing processes.

The method pursued by the alum makers to find the specific gravity of any liquid is capable of considerable accuracy. A bottle is procured, that will contain about $\frac{1}{3}$ of a pint. The narrower the neck, the more accurate will be the results obtained by it. This bottle is balanced in a pair of sensible scales, we will suppose it to weigh 1000 grains, it is then filled with distilled water, and carefully dried with a cloth; now allowing the water to weigh 2400 grains, this last number is divided into 80 parts or pennyweights, and we have 30 grains corresponding to one pennyweight; this they subdivide into $\frac{1}{2}$ and $\frac{1}{4}$. Hence we may ascertain the relative specific gravity of any liquid. 1 pennyweight is equivalent to 1·0125, and 80 pennyweights to 2·0. Care however is necessary, to have a counterweight of 3400 grains, equal in weight to the water and bottle together, which must always be put into the scale, along with the other weights, in operating. This was formerly a great secret among the alum makers, and they sold the method at a high price, or handed it down to their children as an hereditary possession.

Considerable advantage might be derived to the manufacturer, by reducing the size of the fire places, and erecting iron doors, to prevent a current of air passing over the fire, instead of entering by the ash pit: a very material saving of fuel would arise from adopting this method.

A very material error is committed, by concentrating the liquor in the pans to near the specific gravity of 1·5, and then re-

ducing it again to 1·35: this method obliges them to evaporate a very unnecessary quantity of water.

The alum liquor is frequently brought into the pans as low as 1·09; when by repeatedly bringing the liquor over fresh calcined mine, it might be concentrated to 1·25, or more. I will mention an instance where the expenditure in evaporating liquor was more than £3 10*s*. daily; when at the same time this liquor might have been concentrated to an equal degree, by repeatedly pumping the liquor upon fresh calcined mine, at an expense of not more than 9*s*. in the same time; here there was a loss of £3 1*s*. daily.

In using black ashes, or kelp, a considerable quantity of charcoal is dissolved in the alkaline lee; this charcoal is precipitated on adding a small quantity of the solution of sulphate of alumine, but is redissolved again by adding the solution in excess.

This charcoal then contaminates the alum, and decomposes a quantity of the sulphuric acid: therefore, it must appear conclusive, that whatever alum is made with muriate of potash alone will be far superior in quality, while the produce will be greater in quantity.

It might be supposed, that urine was a necessary ingredient in the making of alum; but the fact is, it merely hides the ignorance of an alum maker. Having no determinate rule to guide him, in reducing the liquor from the pans, should he chance to exceed the specific gravity of 1·35, he adds urine, or some such light fluid, to bring the liquor as near as possible to this density. The alum works, that approach the nearest to the true chemical principles, are those of the Right Hon. Lord Dundas, and Messrs. Baker and Co. They use no urine in these works—the alum liquor is always clarified previous to its being used—they use no alkali generally, but crystallized muriate of potash—greater economy is observed in the consumption of fuel; and the result is a product of alum considerably larger in a given time, and of better quality, than can be produced by the works established upon the old plan.

The kelp used is obtained by burning the sea wrack in kilns,

at a great number of places upon the coast of England, Scotland, &c. It is a very inferior alkali in an alum manufactory. It contains about 47 of soluble salts, and 53 of charcoal, sand, and earth. The salts are muriate of soda, soda, and sulphate of soda.

The refuse of the soap boilers' lees are burnt in a kind of oven, and sold under the name of black ashes. The composition of these ashes is about 90 of soluble salts, and 10 of charcoal and earth, the salts contain muriates of soda and potash, sulphate of potash, and muriates of lime and magnesia.

I have always found great difficulty in producing alum by the muriate of soda, and never could form alum in any way by means of pure soda.

The muriate and sulphate of potash are the only alkalis that can be used to advantage in the composition of alum.

I have made comparative experiments to ascertain the quantity of the different alkalis it would require to produce 100 tons of alum. The following are the results:

22 tons of muriate of potash will produce	100 tons of alum,
31 ditto of black ashes	100 ditto,
73 ditto of kelp	100 ditto.

The alkalis are considered as in the state in which they are found in commerce.

ON A NEW BLACK DYE TO BE APPLIED TO ALL KINDS OF LINENS AND STUFFS.

By Mr. HERMBSTAEDT, *Berlin.**

THE black colours which are generally applied to linen and cotton stuffs are composed of iron and vinegar. Their base is always oxide of iron, which is mixed with decoctions of wood of different kinds. All these colours incline either to red or blue, and they resist but feebly the action of the air, of water, and of acids. The tincture which I have composed, and which I use

* From Biblioth. Phys. Economique, an xiv. No. 2

daily in dyeing all kinds of cotton, silk, or wool stuffs to an unalterable black, embraces an intimate union of the oxide of iron with that of copper and the pyro-ligneous acid.

Preparation of the Pyro-ligneous Acid

Take a tubulated retort made of plate iron, or of cast iron which is better, place it in a furnace in such a manner that the neck be perfectly free, and the bottom receive directly the heat of the fire. It must be luted carefully, and there must be introduced into the retort some chesnut wood cut into small bits. The distillation then commences with a very moderate fire, which is progressively increased till no more liquid passes into the receiver. The acid which is found in the receiver, mixed with a kind of oil, may be separated from it by a filter of gray paper: the wood will be reduced to charcoal in the retort.*

Preparation of the Oxide of Iron.

Dissolve 4 pounds of vitriol (sulphate) of iron, very pure, in 24 pounds of rain water. Dissolve in like manner 4 pounds of potash in 12 pounds of filtered water. These two solutions, when well mixed, will appear at the beginning of a deep green; but in a little time the surface exposed to the air will take a dark red colour; then pour the whole on a filter of linen: the oxide which will remain after the water has passed ought to be washed in a great deal of water, to free it from all adhering salt. Leave this oxide exposed on a plate to the action of the atmosphere, which will reduce it to a state of red oxide.

Preparation of the Oxide of Copper.

To prepare this oxide, take a pound of blue vitriol of Cyprus (sulphate of copper), which dissolve in 12 pounds of rain water: make it boil, and mix with it a pound of water saturated with potash, and you will obtain a green precipitate, which must be well washed after being filtered.

* Compare Archives, Vol. 1, p. 406. *Editor.*

Preparation of the Mordant for Black.

Take three parts of the oxide of iron and one part of the oxide of copper: triturate them in a marble mortar, and pour on them the necessary quantity of pyro-ligneous acid to dissolve them. Filter the whole to separate the thick parts, and the mordant is made.

Application of this Mordant in dyeing Black.

Steep the stuffs intended to be dyed in this mordant thickened at pleasure. Afterwards proceed to the dyeing in the ordinary decoctions made with different dye-woods. The colour obtained will be a very beautiful black, and almost unchangeable by all chemical agents. If the black is meant to serve for printing stuffs or cloths, it is thickened very much, and by mixing it with different tinctures of dye-wood, it will form a black equally beautiful and lasting.

PROCESS EMPLOYED TO OBTAIN A LIQUID BLACK,

Invented by Mr. Clarke, an Englishman, and introduced into commerce; its use in marking linen in a solid and durable manner, and its application for printing cottons or stuffs.

By Mr. HERMSTAEDT, *of Berlin.*

FOR these two or three years past, a black tincture has been sold for the purpose of marking linen.

A glass polisher and directions for using the tincture accompany the two bottles which contain the ingredients, and the whole is sealed up in a case.

One of the bottles contains the mordant. The other contains the ink, which is of a deep brown colour, and which must be well shaken before making use of it, because it subsides when left to rest.

The part of the linen intended to be marked, must be in the first place impregnated with the mordant, which is allowed to dry

on the linen. The place which had been wetted is then rubbed with the polisher; an ordinary pen is then dipped in the ink, and the writing is performed on the linen the same as on paper. Neither soap nor any chemical preparation will destroy this writing, which, when well dried, is of a very fine black.

Having chemically analysed these two liquids, I am able to give an accaunt of the ingredients which compose them.

Preparation of the Ink.

Dissolve in nitric acid (aquafortis) what quantity of silver you please. This solution, if the silver has been alloyed with copper, will be of a sapphire blue.

In order to separate the copper from the silver add to the solution twelve times its weight of distilled water, or, for want of it, rain water, and suspend in it a thin plate of copper. In proportion as this plate dissolves, the silver will precipitate itself, perfectly pure, in the form of a white powder. When no more of this powder will precipitate itself the liquor should be decanted. The powder is then washed in a great quantity of water, until the water thrown upon it is no longer of a blue cast, but remains perfectly limped. The residue, *i. e.* this powder, well dried, will be silver in its purest state.

If this residue weighs one ounce, dissolve as much gum senegal and two drachms of white glue in two ounces of distilled water. Mix this solution wich three drachms of lamp-black well calcined in a close crucible.

To manufacture this mixture properly, it ought to be triturated in a glass mortar.

This operation being finished, the solution of silver, diluted in eight times its weight of distilled water, is poured upon the above mixture; the whole is then well stirred with a spatula, and the ink is made.

Preparation of the Mordant.

Dissolve two ounces of white glue and as much isinglass in six ounces of alcohol, and as much distilled water. This solution

will be made in two days. The B. M. is made use of for the purpose; and care must be taken to stir the two kinds of glue from time to time.

After the whole is dissolved, it must be filtered through flannel, in order to keep back all its mucilaginous particles. The liquid thus filtered, and preserved in a bottle well corked, is then ready for use.

Manner in which the Ink acts.

The solution of silver in the nitric acid is nothing else than the composition of the *lapis infernalis;* and every one knows its properties in staining the skin, nails, &c., of a black colour. If the linen or stuff is first impregnated with the above mordant, which is an animal substance, the ink may be afterwards applied without spreading, and will completely dye every thread of the part to which it is applied, the mordant having previously partly animalized the fibre of the fabric.

Soap, or any other ingredient used in washing, may obliterate the lamp black, but it never takes out the nitrate of silver; and the object proposed is therefore perfectly well attained.

Application of the Ink for printing orange Cotton and other stuffs.

We may easily conceive that this ink may be employed with advantage for printing cloths of a white, yellow, or rose ground, or any other clear colour.

The cloths or stuffs intended to be printed in this manner require no other preparation than to be dipped in a solution of parchment or isinglass; and after they are dried they must be rubbed with a glass polisher.

The ink must be thickened for this purpose with a greater quantity of gum senegal, and then applied upon the cloths or stuffs in the usual manner by means of wooden or metal stamps.

Three or four days after this operation the stuffs must be first washed with a great quantity of clear water, and afterwards with soap and water, which will make them appear of a finer black.

THE PROCESS FOR DYEING NANKEEN COLOUR.

*By Richard Brewer.**

MIX as much sheep's dung in clear water as will make it appear of the colour of grass, and dissolve in clear water one pound of best white soap for every ten pounds of cotton-yarn, or in that proportion for a greater or lesser quantity.

Observe: The tubs, boards, and poles, that are used in the following operations, must be made of deal; the boiling pan of either iron or copper.

First operation.—Pour the soap liquor, prepared as above, into the boiling pan; strain the dung liquor through a sieve; add as much thereof to the soap liquor in the pan as will be sufficient to boil the yarn, intended to be dyed, for five hours. When the liquors are well mixed in the pan, enter the yarn, light the fire under the pan, and bring the liquor to boil in about two hours, observing to increase the heat regularly during that period. Continue it boiling for three hours, then take the yarn out of the pan, wash it, wring it, and hang it in a shed on poles to dry. When dry, take it into a stove or other room where there is a fire; let it hang there until it be thoroughly dry.

N. B. The cotton yarn, when in the shed, should not be exposed either to the rain or sun; if it is, it will be unequally coloured when dyed.

Second operation.—In this operation use only one half of the soap that was used in the last, and as much dung liquor (strained as before directed) as will be sufficient to cover the cotton yarn, when in the pan, about two inches. When these liquors are well mixed in the pan, enter the yarn, light the fire, and bring the liquor to boil in about one hour; then take the yarn out, wring it without washing, and hang it to dry as in the former operation.

* From Transactions of the Dublin Society, Vol. 1, part 1.

Third operation.—This operation the same as the second in every respect.

Fourth operation.—For every ten pounds of yarn make a clear ley from half a pound of pot or pearl ashes. Pour the ley into the boiling pan, and add as much clear water as will be sufficient to boil the yarn for two hours; then enter the yarn, light the fire, and bring it to boil in about an hour. Continue it boiling about an hour, then take the yarn out, wash it very well in clear water, wring it, and hang it to dry as in former operations.

N. B. This operation is to cleanse the yarn from any oleaginous matter, that may remain in it after boiling in the soap and dung liquors.

Fifth operation.—To every gallon of iron liquor* add half a pound of ruddle, or red chalk, (the last the best) well pulverised. Mix them well together, and let the liquor stand four hours, in order that the heavy particles may subside; then pour the clear liquor into the boiling pan, and bring it to such a degree of heat as a person can well bear his hand in it; divide the yarn into small parcels, about five hanks in each; soak each parcel or handful very well in the above liquor, wring it and lay it down on a clean deal board. When all the yarn is handed through the liquor, the last handful must be taken up and soaked in the liquor a second time, and every other handful in succession, till the whole is gone through; then lay the yarn down in a tub, wherein there must be put a sufficient quantity of ley made from pot or pearl ashes, as will cover it about six inches. Let it lie in this state about two hours, then hand it over in the ley, wring it, and lay it down on a clean board. If it does not appear sufficiently deep in colour, this operation must be repeated till it has acquired a sufficient degree of darkness of colour; this done, it must be hung to dry as in former operations.

N. B. Any degree of red or yellow hue may be given to the

* Iron liquor is what the linen printers use.

yarn by increasing or diminishing the quantity of ruddle or red chalk.

Sixth operation.—For every ten pounds of yarn make a ley from half a pound of pot or pearl ashes; pour the clear ley into the boiling pan; add a sufficient quantity of water thereto, that will cover the yarn about four inches; light the fire, and enter the yarn, when the liquor is a little warm; observe to keep it constantly under the liquor for two hours; increase the heat regularly till it come to a scald; then take the yarn out, wash it, and hang it to dry as in former operations.

Seventh operation.—Make a sour liquor of oil of vitriol and water; the degree of acidity may be a little less than the juice of lemons; lay the yarn in it for about an hour, then take it out, wash it very well and wring it; give it a second washing and wringing, and lay it on a board.

N. B. This operation is to dissolve the metallic particles, and remove the ferruginous matter, that remains on the surface of the thread after the fifth operation.

Eighth operation.—For every ten pounds of yarn dissolve one pound of best white soap in clear water, and add as much water to this liquor in your boiling pan, as will be sufficient to boil the yarn for two hours. When these liquors are well mixed, light the fire, enter the yarn, and bring the liquor to boil in about an hour. Continue it boiling slowly an hour; take it out, wash it in clear water very well, and hang it to dry as in former operations: when dry, it is ready for the weaver.

N. B. It appears to me, from experiments that I have made, that less than four operations in the preparation of the yarn will not be sufficient to cleanse the pores of the fibres of the cotton, and render the colour permanent.

THE METHOD OF GILDING ON GLASS.*

By Richard Hand.

TAKE a piece of parchment, about twice the size of a crown piece; put it in a pint of water; in the evening and in the morning, beat it for about half an hour, and it will be fit for use.

Take a small brush, and give the glass, which is to be gilt, a thin coat. Get your gold ready to lay on, breathe on the size which is on the glass, and lay on the gold. When all is covered with gold, rub it with cotton, when dry; then give the gold another coat of that size, and do as above, by breathing on the gold and putting on another coat. When the whole is covered with gold, rub it with the cotton, then give it another coat of size, and on that lay on leaf silver, until all is covered. Rub the silver with cotton; then have ready some water about blood warm, put the glass which is gilt in it, and let it stand about a quarter of an hour; take it out and let it dry, and when dry, proceed to varnish it.

SPIRIT VARNISH.†

By Richard Hand.

THERE are various kinds of spirit varnish, all of which I have made and used; but as the hardest varnish of the spirit kind is the best for gilding on glass, the following, in my opinion, is by far the most preferable.

Take of rectified spirits of wine one quart, gum animi two ounces, seed-lac three ounces, gum mastic one ounce; keep it in a warm place, and the gums will dissolve in the spirits, which must be strained through a flannel cloth and then kept for use.

This varnish, as well as all others formed of spirits, must be laid on the work, to be varnished, warm; for either cold or

* From the Transactions of the Dublin Society, Vol. 1, part 1. † Ibid.

moisture chills all spirit varnish, and prevents its taking proper hold of the substance, on which it is laid.

N. B. A very fine painted glass window of Mr. Hand's performance, is put up in the Museum of the Society.

PROCESS TO DISCOVER ADULTERATED POTASH.

*By Wm. Higgins, M. D. professor of Chemistry and Mineralogy to the Dublin Society.**

AS pot-ash is the principal agent in the bleaching of linen, no foreign article imported into this country deserves more attention.

Pearl or pot-ash contains from 10 to 12 per cent. of impurities, mostly sulphat of pot-ash, and sometimes a small portion of muriate† of pot-ash. These salts must have been yielded by the wood, and dissolved by the large quantity of water necessary to separate the pot-ash from the ashes.

I more than once obtained near 20 per cent. of sulphat of pot-ash from the pearl-ash imported here; this great portion of sulphat of pot-ash could have never been a natural product, but must have been an artificial adulteration; and indeed, circumstances have convinced me that it must be so.

During a mineralogical excursion through England in the summer and autumn of the year 1785, the different manufactures, which fell in my way, were not passed over. Upon enquiring of the distillers of aquafortis (nitrous acid) how they disposed of the large residum left in the still (when the acid was carried over) which is sulphat of pot-ash, and which is of little or no use in the arts, they informed me it was bought up by the Irish merchants.

Sulphat of pot-ash, when ground down, cannot readily be distinguished as to its external appearance from pearl-ash, and be-

* From Transactions of the Dublin Society, Vol. 1, part 1.

† Muriate of pot-ash, a neutral salt, consisting of marine acid and pure pot-ash.

ing so much cheaper than the latter, is well calculated for the above fraudulent purpose.

By no means do I intimate that this is a common practice, as from experience I know the contrary.

However to pass it over in silence would be unpardonable, when it is considered that the bleacher is at the expense of an article of no use whatever in bleaching, and that, by the adulteration, the proportion best known by experience to answer his purpose is varied; by which means his process, although not altogether frustrated, must be materially retarded.

Sulphat of pot-ash is only soluble in about sixteen times its weight of water, in the temperatue of 60°, while real pot-ash is soluble in its own weight of water, in the same temperature; hence they are easily separated in the following simple manner, viz. three pounds of pearl-ash and two quarts of water should boil together for a few minutes, then be removed from the fire and suffered to stand for twenty-four hours, when the clear liquor is to be decanted off. Half a pint more of cold water is to be poured upon the dregs, and this again drawn off when clear: the insoluble salt is afterwards to be well dried and weighed, which being a foreign salt, will give pretty nearly the quantity of impurities in the pot-ash.

The purest pot-ash imported, always contains, as I have before observed, a certain quantity of sulphat of pot-ash (vitriolated tartar); and this quantity is no doubt the natural production of the vegitable itself which affords the pot-ash. Some muriate of pot-ash (regenerated sea salt) has occasionally been found in it; but in portions too inconsiderable to injure any art or manufacture, in which pot-ash is used.

Within the last year however I have discovered, to my great surprise, in several specimens of pot-ash, which I have examined for the bleachers, a large quantity of muriate of soda (common sea salt). The last specimen of this sort was examined by my pupils, under my own immediate inspection, in the Laboratory of the Dublin Society, and it afforded upwards of one-fifth of foreign salt; the proportion being as follows.

	Grs.
Aerated (mild) pot-ash - - - -	1690
Muriate of soda - - - - -	270
Sulphat of pot-ash - - - - -	200
Total, - - - - -	2160

This last analysis was made for a Mr. Harrison, an eminent glass manufacturer at Belfast, who had suffered very materially in his manufacture, by the adulteration of his pot-ash; and I have no doubt, that rock salt, which is the same as common salt, but much cheaper than that which is prepared for commerce, was mixed in powder with the pot-ash previous to its importation. Muriate of soda, being besides much more soluble in water than sulphat of pot-ash, is less easily detected, and separated from the pot-ash.

The following is the method, which I adopted for determining the nature and proportion of the ingredients.

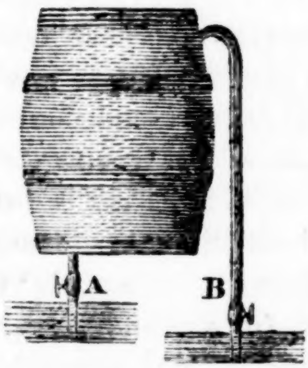
The specimen having been first weighed, was digested for a few minutes on a sand bath, twice its weight of water, in a heat of about 212, and instantly stirred. It was then removed from the sand bath, and before cooled to the temperature of the atmosphere, filtered through paper. As soon as all the liquor had passed through the filter, a small quantity of cold water was poured, from time to time, upon the saline residuum upon the filter, in order to wash through the whole of the pot-ash. The undissolved salt, which was sulphat of pot-ash, was afterwards dried and weighed. In the clear solution, however, there remained, not merely the pot-ash, but such salts as possessed sufficient solubility to be taken up along with it by the water, though in fact not so soluble as the pot-ash itself. To get at these the following means were used; the clear solution was evaporated down a little on the sand bath, and set by in a cold place for 24 hours: at the end of which time, a quantity of common salt was found crystalized in regular cubes at the bottom of the vessel. From these the liquor was perfectly drained, and being preserved, the same

process was repeated, till there ceased to be any deposition of cubic crystals.

Before the muriate of soda, thus procured, was weighed, some muriatic acid was poured on it, in order to take up any of the pure pot-ash, which might have adhered to it during its crystalization. The muriatic acid, with such of the pot-ash as it had found and dissolved, was then drained off and thrown away, and the muriate of soda dried and weighed. The sum of the impurities being then substracted from the weight of the specimen, the quantity of the pot-ash was ascertained.

This new species of adulteration must be a great drawback on our staple manufacture, and deserves therefore very serious consideration.

The Syphon applied to the Worm Tub as a Refrigerator; or, A Plan for conveying Water in any Quantity to a Worm Tub of the largest Dimensions, if perfectly air tight. By ALEXANDER JOHNSTON, Engineer.*



A. The feed pipe of cold water.

B. The hot water, or waste pipe, the end of which must be about two feet lower than the feed pipe, to make it act with full effect.

When you commence work, you must shut the cocks, and fill the tub through a hole at top, (and of course both pipes) and, when full, stop the hole at top, and open the cocks together; the

* From *Transactions of the Dublin Society*, vol. iii.

water will then commence running, and continue as long as the supply holds good, as it acts in every respect on the principle of a syphon.

By this means pumps, horse mills, and other machinery, are rendered unnecessary for that purpose.

The application of this improvement is simple, and executed at a very little expense. The saving, I think, may be calculated at upwards of one hundred horses per annum, for the city of Dublin alone.

I have executed one for Nicholas Roe, esq. Marybone-lane.

Dublin, July 6, 1803. ALEXANDER JOHNSTON.

ON THE CONVERSION OF IRON INTO STEEL BY CEMENTATION—ON CASE HARDENING—ON CAST STEEL.*

THE usual method of converting iron into steel is by *cementation*.† For the purposes of manufacture, this is performed in large quantities at a time in the following manner. A cementation or converting furnace consists of two parallel troughs, constructed of fire-brick, sufficiently long to admit with convenience a common bar of iron; these troughs rest upon a long grate from which flues proceed, so as to distribute the heat as evenly as possible to every part: an arched vault is thrown over the top, and the whole is inclosed within a cone of masonry as the glass house furnaces are. The bars of iron intended for cementation are of the very best quality, (in England none but the Swedish Oregrund iron is employed for this purpose) and are carefully examined to ascertain that they are quite free from cracks, flaws, and every appearance indicative of their not being completely malleable. The requisite selection being made, a stratum of coarsely bruised charcoal is laid at the bottom of the cementing trough, upon which is arranged a layer of iron bars: to this

* From Aikin's Chemical Dictionary.

† Collier in Manch. Trans. V. p. 122. [Mr. Collier gives a plate of the cementing furnace. *Editor.*]

succeeds another of charcoal, and so on till the trough is nearly filled, observing that the upper as well as the lowest layer is charcoal: it is then covered with a mixture of hard rammed clay and sand in order to exclude the air. A trough thus charged will contain from seven to ten tons of iron. The fire being lighted, the heat passes into the flues and raises the temperature of the troughs to a glowing red, which is maintained for the space of from seven to eleven days, according to the quantity of iron. At the extremity of each trough is a small hole, through which two or three bars project a few inches in order that they may be occasionally withdrawn to ascertain the progress of cementation: when by the trial bars, it appears to be complete, the fire is put out, and after the troughs are sufficiently cool they are emptied of their contents. The form of the bars thus converted, remains unaltered, but their surface is covered over with bubbles or blisters, whence the steel in this state is called *blister steel:* it is heavier than the iron from which it was made, on account of its having absorbed a portion of carbon from the charcoal with which it was in contact, though this is by no means the only action that takes place in the process of steel-making, as we shall show in the next section. Blister steel is employed only for the coarsest purposes, such as pointing horses' shoes, ploughs, and other agricultural instruments, &c. By being drawn down into smaller bars under the tilt-hammer, its texture is considerably improved, and it is known in the markets by the name of *tilted steel.* As repeated hammering improves iron, so it does steel: hence if a bar of highly carbonized blister steel is broken into very short pieces, and these being formed into small packets, are again welded together and drawn down into bars, which being again doubled together are welded and tilted, repeating the process two or three times, the result will be a very material improvement in compactness and toughness, and the metal will be found well qualified for swords and the larger articles of cutlery: this steel has long been prepared in high perfection in Germany, whence it is called *German steel;* it is also known by the name of *shear-steel.*

This is the proper place to mention the process of *case-hardening*, which in fact is only an imperfect kind of cementation, converting little else than the immediate surface of the metal into steel, and therefore being performed not on the rough bar but the manufactured article. The cements or carbonaceous substances used on this occasion are bone shavings or turnings, horn cuttings, and old leather shoes. The work intended to be cased having been previously filed to the requisite shape, that there may be as little occasion as possible to apply the file afterwards, is laid together with the cement in a pan of plate-iron. A forge fire is then made of considerable size, and when the upper part has caked together it is carefully lifted off without breaking, the pan is laid upon the red coals and covered with the caked mass. In this state it remains for nearly two hours, without urging the fire. Small pieces of iron wire that have been previously introduced into the pan being withdrawn from time to time, are dipped while hot in cold water, and by the file and the character of the fracture, the progress of the cementation is determined. When the intended degree of carburation is obtained, the fire is increased, and the articles as soon as sufficiently heated are taken out of the pan and plunged in cold water. The inferior kinds of table-knives and some surgical instruments, where a considerable degree both of toughness and hardness is required, are prepared in this way.*

The finest kind of steel, however, called *English cast steel*, yet remains to be mentioned. It is commonly prepared by breaking to pieces the blister steel, and then melting it in a crucible with a flux composed of carbonaceous and vitrefiable ingredients. When thoroughly fused it is cast into ingots, which by gentle heating and careful hammering, are tilted into bars. By this process the steel becomes more highly carbonized in proportion to the quantity of flux, and in consequence is more brittle and fusible than before; it is inferior to the other kinds of steel in being incapa-

* For the above, and some other practical information contained in this article, the authors are indebted to the professional liberality of Mr. W. H. Pepys.

ble of welding either with iron or steel, but on the other hand, surpasses them all in uniformity of texture, hardness, and closeness of grain, hence it is the material of all the finest articles of English cutlery. The composition of the flux used in preparing this steel is kept a secret among a few manufacturers, and in consequence various experiments have been instituted both here and elsewhere, to discover either the same or an equally successful method of making this beautiful substance. In 1795, Clouet published the results of some valuable experiments, from which it appears, that by simply fusing bar iron with charcoal, a cast steel may be obtained more or less carburetted, according to the proportion of charcoal employed, and therefore possessing at pleasure in a greater or less degree, the qualities of fusibility, brittleness, and hardness: he also showed that the same effects may be produced by fusing bar iron with glass and charcoal, or the black oxyd of iron, with the requisite proportion of charcoal alone, or by keeping in fusion for about the space of an hour a mixture of small bits of iron and equal parts of clay and marble or any other calcareous carbonat.* In 1800, Mr. Mushet took out a patent for preparing cast steel of various qualities, by fusing bar iron with different proportions of charcoal, coinciding for the most part with the facts and principles before laid down by Clouet, and confirmed by his own experiments;† but whether the steel thus prepared is equal to the finest cast steel of Huntsman, has not we believe been as yet completely ascertained.

Steel is rendered hard by heating and then suddenly cooling it. The degree of hardness which it is capable of acquiring is in direct proportion to its fusibility, or in other words to the quantity of carbon with which it is combined; and the degree of hardness which in any particular instance is actually given to it, is in proportion to the difference of temperature between the medium in which it is heated and that in which it is cooled; modified however by the capacity for heat and the conducting power of the cooling medium. Thus if steel is heated somewhat below

* Journal des Mines, No. 49. † Repertory xiv. p. 176.

the degree at which it melts and then transferred into oil at the temperature of 200°, the hardness thus acquired will be inferior to that which would have been obtained if water, or still more so if mercury, at the same temperature had been made use of. Again, if instead of oil at 200° the same fluid at 40° had been employed, a greatly superior degree of hardness would have been produced.

The hardness acquired by this method has generally been thus accounted for. The particles of the metal by being heated are placed at a greater distance from each other than before, and in proportion as this heat is again abstracted, the attraction subsisting between them will become efficacious, and they will approach nearer to actual contact; but the impetus with which this takes place will be in proportion to the difference of temperature, and therefore when red-hot steel is plunged in ice-cold mercury, the force or resilient spring of its particles will be greater than if mercury at 200° had been made use of, and consequently its hardness will also be greater. But this theory, however ingenious, is opposed by certain facts which perhaps may be found more consonant with the following explanation of them.

If we take the specific gravity of a piece of steel both when hardened and after it has been softened by heating again and gradually cooling, we shall find that its bulk in the former case is greater than in the latter, whereas if the hardness of steel was owing to the rapidity and energy with which its particles collapsed on cooling, directly the reverse of this ought to take place, the state of greatest hardness should be that of the greatest specific gravity. So in like manner we find to be the case with glass; if a little of this in a melted state is dropped into cold water it will prove very hard and brittle; but if the same piece is again heated red (without however in any degree softening it) and afterwards allowed to cool gradually, its specific gravity will have very notably increased, and it will have become tough and elastic. We may therefore consider the hardening of steel to be caused by the contemporaneous expulsion of part of its heat and the fixation of its particles before they have had time to arrange

themselves and contract upon each other. Hence on the impression of any external force, the particles that are struck are not able to slide on each others surfaces, and thus distribute the impetus which they have received over the contiguous ones; or in other words the mass becomes *harder* than it was before, hence also the whole force of a blow is borne by a comparatively small number of insulated particles, and these entirely giving way before a degree of percussion that might easily be sustained by the whole when combined, thus produce the quality of *brittleness*.

If highly carburetted steel is made nearly as hot as it can bear without melting, and is then plunged in very cold water, it is apt to fly to pieces, and even if this does not take place the metal is not applicable to any use in this state of extreme hardness, for the particles are placed so far asunder that the whole has a strong tendency to become crumbly, and will not bear a fine even sharp edge. In the practice of the best manufacturers the hardening heat even for files, which are the hardest of all steel instruments, is not greater than a red visible by day-light; and all cutting and elastic instruments require to be much softer. The various degrees of hardness necessary for different articles are not however given, as might at first be supposed, by the simple process of hardening at the requisite temperature, but by the compound method of first giving to every article nearly a file hardness, and then, by the subsequent process of *tempering*, reducing the hardness to the particular degree necessary for each article.

Tempering consists in softening hardened steel by the application of a heat not greater than that which was employed in hardening it; for this purpose it is gradually heated more or less according to the temper required, and cooled again either gradually or rapidly, this making no difference; after which the steel is found to be softened or tempered exactly in proportion to the heat which it has undergone. While the steel is tempering, its surface displays a succession of colours (supposed to arise from a commencing oxydation) in proportion as it becomes more and more heated, which the workmen in this metal have ingeniously taken advantage of, as indicating and serving to denominate the

degree of temper required for different articles. The first perceptible colour is a light straw yellow, and this being produced by a small degree of heat indicates the highest or hardest temper; to this succeeds a full yellow, then a brown, afterwards a reddish blue, then a light blue, and lastly a full deep blue passing into black, which being the other extremity of the series denotes the lowest degree of temper, and a hardness only a little superior to what the piece of steel would have acquired if when heated for the purpose of being hardened it had been allowed to cool gradually instead of being plunged into a cold liquid. The old method of tempering, and which indeed is still practised by most manufacturers, is to lay the articles on a clear coal fire, or on a hot bar, till they exhibit the requisite colour; but small articles, which were to be reduced to a blue temper, were commonly *blazed*, that is, they were first dipped in oil or melted grease, and then held over a fire till the oil became inflamed, and thus evaporated.

Some particular articles require a nicety of temper that is not very easily attained by trusting merely to the change of colour, a circumstance that induced Mr. Hartley, in the year 1789, to take out a patent for a new and more accurate method. For this purpose a mercurial thermometer graduated as high as 600°, is to be immersed in an iron trough heated by a furnace or lamp placed below it and filled with fusible metal, upon the surface of which the steel is to be laid, which may thus be tempered with great accuracy at any degree of the thermometer that the artist chooses. Oil may be substituted to the fusible metal, and the effect will be the same, except that the steel being in this case tempered beneath the surface of the liquid, and of course out of the contact of atmospherical air, will not exhibit those changes of colour which take place when the other methods are employed. The following table shows the temperature at which the various colours make their appearance.

430° to 450° indicates the several tints of straw colour, and is the temper for razors and those instruments which have a stout back supporting a keen and delicate edge.
470° corresponds with the full yellow, and is the proper temper for scalpels, pen-knives, and other fine-edged instruments.
490° indicates the brown yellow, and is the proper temper for scissars and small shears.
510° indicates the first tinge of purple, and is the temper for pocket and pruning knives.
530° indicates purple, and is the temper for table and carving-knives.
550° to 560° indicates the different shades of blue, and is the temper for watch-springs, swords, and all those instruments in which great elasticity is required.
600° corresponds with black, and is the lowest degree of temper.

One great advantage attending the use of cast steel is its uniform quality: the carbon which it contains appears to be equally distributed through every part of the same mass in consequence of the fusion that it has undergone; whereas both the natural steel and the steel of cementation are apt to contain veins of iron, either quite soft or at most very slightly carburetted, and thus a degree of imperfection and uncertainty is introduced extremely mortifying to the artist, and not unfrequently the occasion of much labour in vain. It is therefore no small benefit which Mr. Nicholson has conferred on the workers in iron and steel by publishing a simple and effectual method of ascertaining whether any particular bar is pure iron or steel, or a mixture of both.* The surface of the metal being cleaned with a file or with emery paper, is to be spread over with very dilute nitrous acid, by which the iron will be dissolved, but the carbon will remain behind untouched; after therefore the acid has been allowed to act for a few minutes, the bar is to be put into clean water and moved about in it gently, that both the residual acid and the nitrat of iron may be washed away, care being taken not to touch the surface with the hand or any thing else that may rub off the carbon. The bar thus washed, if pure iron, will exhibit an uniform iron-gray colour; if it is pure steel, the colour of the surface will be black, the iron having been taken up by the acid and a thin coating of carbon remaining; but if it is a mixture of iron and steel the surface will be dotted or streaked, those parts which are steel

* Nich. Phil. Journ. 4to. i. p. 470

being of a dull black, and those which are iron exhibiting the usual colour and lustre of this metal.

Steel being considerably more expensive than iron, it is customary in making the larger and coarser kinds of cutting instruments to form only the edge of steel. The two bars of iron and steel are first welded together and afterwards forged into the requisite shape in the usual manner. Highly carbonized steel is however incapable of being thus united to iron, because the same temperature at which iron welds freely is that at which this kind of steel enters into fusion, and therefore the first stroke of the hammer will entirely shatter the steel and disperse it about in small fragments. This however is a difficulty which it is well worth while taking some pains to overcome, as the efficacy and durability of instruments thus composed, materially depends upon the goodness of the steel. The most effectual way hitherto discovered of uniting together iron and highly carbonized steel, is that published by Sir Thos. Frankland.* The iron is to be raised to a welding heat, in one forge, and the steel is to be made as hot as it can bear without becoming very brittle, in another; both pieces are then to be quickly brought to the anvil and made to adhere together by gentle hammering.

Several curious pieces of work are made of iron and steel welded together, especially the real Damascus sword blades, which are believed to be composed of slips or thin rods of iron and steel, bound together with iron wire, and the whole firmly cemented together by welding. The properties and external appearance of such a blade correspond very exactly with the supposed mode in which it is manufactured. Its colour is a

* The Editor can state, that no less than three experiments failed to weld Huntsman's cast steel to iron, agreeably to Sir Thos. Frankland's process, conducted in the presence of the Editor, and at his request, by the late Mr. Schively, cutler, of Philadelphia, and an expert workman. The degrees of heat prescribed for both iron and steel were scrupulously attended to.

This secret process was reserved for the United States. Mr. Pettibone, now of Philadelphia, welds cast steel to iron with ease and expedition. He even plates clothier's shears with steel, or plates iron of any length or breadth; or faces anvils, hammers, or sledges. *Editor.*

dull bluish gray, it is scarcely harder than common steel from the forge, it is not easily bent, and when bent has no elasticity to recover its original figure; but the circumstance which principally characterizes it, is the appearance of narrow waving lines not crossing each other and chiefly running from heel to point; they are ill-defined and about the thickness of a harpsichord wire. This wavy appearance is not produced by any perceptible indentation of the surface, but merely by a slight difference in the degree of polish or brightness, and therefore may be at once distinguished from the false damasking or etching by which other sword-blades are made to resemble the genuine Damascus ones. In the false Damascus blades, the waving lines, called the *water*, are obliterated by grinding, but in the real ones, although the water is at first imperceptible after grinding, yet it may at any time be made to reappear by rubbing the blade with lemon juice, no doubt on account of the unequal action of this weak acid on a surface composed both of steel and iron.*

Besides the varieties of steel that we have already described there yet remains one more, concerning which a few words will be necessary; this is Wootz.† The substance known by this name in India, is imported into this country in the form of round flat cakes, about five inches in diameter and one inch in thickness. When cold it is uncommonly refractory, neither breaking nor bending under the hammer. It is not nearly so easy to be filed as either bar or cast steel, before these have been hardened: it takes an extremely high brilliant polish; its fracture is moderately close, resembling that of blister steel that has been heated and hammered a little. When nearly white hot it is malleable, but is much more likely to crack under this treatment than even cast steel; it requires therefore much care, labour, and time, to fashion it into any required shape. When made white hot it exhibits the glassy smooth surface of welding iron, but when struck very gently with a hammer, it cracks in many places,

* Nich. Phil. Journ. 4to. i. p. 469. † Pearson in Phil. Trans. lxxxv. p. 322

and by a harder blow is shivered to pieces. When brought to a high heat and quenched suddenly in cold water, it becomes harder than at first, though not equally so with the finest cast steel in similar circumstances; but on the other hand, it is not capable of being sensibly softened by annealing as the other varieties of steel are. At a high heat it is fusible, and after being melted exhibits a close compact grain, is considerably brittle, and bears a very near resemblance to cast steel. From its analysis and other circumstances, it is considered by Dr. Pearson as differing from steel only in containing a little oxyd of iron.

TO SEPARATE COPPER FROM SILVER.*

SIR,

I INTENDED to have deferred the present communication till such time as I should have it in my power to lay before the public the complete series of experiments in which I have been engaged with regard to the purification of gold and silver. But unluckily I mentioned a few particular circumstances with regard to them, to a man who took it upon him, without my knowledge, to send an account of them for publication to a periodical work. As I understand that work will not appear so soon as your next number, I beg, if you think it worthy of a place, that you will insert the following account of some attempts I have been making to purify the precious metals.

Being much at a loss for want of a crucible of pure silver for the analysis of some minerals, and as all the usual methods practised for purifying that metal are very troublesome, I set myself to consider the various operations on metals, in hopes of falling on a more simple way of accomplishing my purpose. At length, I found a process of Pelletier's, which promised to succeed, and mine is merely extending his idea a little further than he did himself.

* From Nicholson's Phil. Journ. Vol. xi.

He was, I believe, employed by the French government to discover an easy way of separating the tin from copper on bell-metal, and the process he gave, is this. Upon the melted bell-metal project black oxide of manganese in powder, frequently stirring the metal till all the tin becomes oxidated by the manganese. He adds a caution, not to add too much manganese, otherwise part of the copper also will be destroyed.

It immediately struck me, that in this way I might be able to oxidate the copper which alloys our silver, and upon making the trial I succeeded completely: I had some impure silver rolled out to about the thickness of a shilling, this I coiled up spirally, and put into a crucible, the bottom of which was covered with black oxide of manganese. I then added more oxide till the silver was covered, and all the space between the coils completely filled. A cover was then luted to the crucible, and a small hole left for the escape of oxigen gass. When this had been exposed for a quarter of an hour to a heat sufficient to melt silver, I found the surface of the manganese brown from the loss of oxigen; but, where the silver had been, the whole was one uniform black powder, without the least appearance of metallic lustre, so that I had no doubt, that even the silver was become an oxide.

I then put the whole contents of the first crucible into a second of a larger size, into the bottom of which I put a quantity of pounded green glass, about three times the bulk of the contents of the first crucible, and luted on a cover as before, to prevent the access of any inflammable substance.

The crucible was then exposed to a heat sufficiently strong to melt the glass very fluid. Upon cooling and breaking the crucible, I found the silver at the bottom perfectly pure, as its oxide alone could part from its oxigen without the access of some inflammable substance. I find this process answers equally well for purifying gold, and to me it seems to possess some advantages over all the former methods. The materials used are cheap, and a large quantity can be refined as soon and as easily as a small quantity, by merely altering the capacity of the crucible you use.

I tried the same operation on gold and silver in round masses.

but found it went on very slowly, and what I scarcely expected, in the first part of the process of oxidating the metals, the remaining metal continued uniformly impure or nearly so, until the whole was oxidated.

I regret that I have been forced to make this matter public, before I could do it in a manner satisfactory to myself. I wished to have given the exact proportions of alloy, manganese, and glass to be generally used, and to have ascertained if there is any truth in the old opinion, that saltpetre melted with gold destroys a part of it. I suppose that idea may have arisen from the oxigen given out by the nitre in a high heat, oxigenating the copper contained in the impure gold, which has been the subject of the experiment.

Since the above was written, I have been informed that this matter has actually been published, but know not in what work. I hope you will still have the goodness to insert this as an *original communication*, as I do not think the person who has published it will have the impudence to call it his own, and as Mr. Kirwan, and other celebrated chemists long ago advised me to publish it, I have already stated my reasons for not following such good advice.

As I have now been forced to appear before the public, I have hopes I shall be able to prevail on some of my friends to commit themselves in the same way, in the confidence that their labours will be found useful to the public.

I am, Sir,

Your's truly,

ANDREW THOMSON.

Banchory, *by Aberdeen*,
May 5th, 1805.

NEW, EASY, AND ECONOMICAL METHOD OF SEPARATING COPPER FROM SILVER. BY MR. GOETTLING.*

THERE are four methods of separating copper from silver, all of which require the alloy to be dissolved in nitric acid. As this acid is very dear, Mr. Goettling thought of using the sulphuric in its stead, which is comparatively very cheap. His success perfectly equalled his expectation, and the following is his method:

Having ascertained by the touchstone, or in any other way, the proportion of silver contained in the alloy, take one part of sulphuric acid for every part of silver, and for every part of copper three parts and three-fifths of a part of the same acid. Dilute the acid with half its weight of water, and pour it into a matrass on the alloy reduced to very small pieces. In order to promote the action of the acid, it is of use to put one part more to every sixteen parts of the alloy. The matrass is then to be placed in a sand-heat, and the acid brought to a state of ebullition. In two or three hours time the alloy is commonly disunited and converted into sulphate, particularly if care be taken to stir the mass from time to time with a glass spatula. This mass is thick, and frequently hard. While it is still hot, six or eight times its weight of boiling water is to be added to it, and it is to be left some time longer on the fire. The sulphate of copper will be dissolved, and great part of the sulphate of silver will be precipitated. The operator will now examine whether the whole be completely dissolved; and if it be, a plate of copper, or some pieces of copper or halfpence tied up loosely in a piece of coarse linen, must be suspended in the mixture, and the whole kept boiling for some hours. The sulphate of silver will thus be decomposed, and the silver separated in the metallic state.

To ascertain whether the separation be complete, a few drops of solution of muriate of soda are to be dropped into a little of the liquor. If a cheeselike precipitate be formed, it is a proof,

* Van Mon's Journal, Vol. 6, translated for Nicholson's Phil. Journ. Vol. xi.

that all the silver is not separated, and in this case the ebullition with the copper must be continued longer. After the whole of the silver is separated, the liquor is to be poured off, the precipitated silver is to be well washed, and the entire separation of the cupreous salt is to be ascertained by the addition of a few drops of liquid ammonia to the water with which the precipitate has been washed, which, if it contain any copper, will be rendered blue by the ammonia. After the silver is thoroughly freed from the sulphate of copper, it may be kept in the state of powder as it is, or it may be fused with a fourth or at most half its weight of sulphate of pot-ash.

The water poured off is then to be mixed with what was used for washing the precipitate, and evaporated in a copper pan, so as to obtain the sulphate of copper by crystallization. The blue vitriol thus produced will be at least equal in value to the sulphuric acid employed.

If any parts of the alloy remained undissolved, it should be separated by decantation, and reserved for a future operation.

ON THE USE OF SULPHATE OF SODA IN GLASS MAKING.*

MY object is to give some account of the attempt made by Dr. Gehlen to employ the sulphate of soda in glass-works; and as I have had an opportunity of seeing the results of his experiments, and conversing with him on the subject of those which he still intends to make, on the different substances that may be employed in glass-houses, I conceive, that the following particulars will not be uninteresting. They who wish for information more at large, may find it in the work which Dr. Gehlen has lately published, entitled *Beytrage zur wissenschaftlichen Begruendung der Glasmacherkunst*, (Attempt to establish the Art of Glassmaking on Scientific Principles,) Munich, 1810.

* Abridged ftom Annales de Chimie, Vol. 79, and translated for Nicholson's Phil. Journal, Supplement to Vol. 31.

From a number of experiments, made in the large way by Mr. Francis Baader and Dr. Gehlen, it appears,

1. That sulphate of soda perfectly freed from its water of crystallization, may be very successfully employed in manufacturing fine white glass, without the addition of pot-ash or soda.

2. That in using this flux there is a considerable gain in point of time; and consequently in the product of a given furnace, and in materials. These advantages arise from a larger quantity of silex being dissolved by sulphate of soda freed from its water of crystallization.

3. That it only requires great accuracy in the addition of the quantity of charcoal necessary to effect the decomposition of the sulphate of soda. This is so essential, that sometimes a single hundredth part too much, or too little, almost spoils the vitrification, or colours the glass. It must be observed too, that it is difficult to give precise directions for the quantity of charcoal to be employed, because the proportion must vary according to its dryness or moisture. If it be moist, it will yield more carbonic acid, which cannot certainly be advantageous to the vitrification.

4. That sulphate of soda cannot be employed so well in substance in the melting pots; but that it is better first to make a sulphuret of soda, in order to get rid of the large quantity of carbonic acid, which is formed in the disoxidation of the sulphuric acid, and would cause too great an effervescence in the melted matter.

5. That the glass-gall is decomposed by an addition of charcoal in all the other manufactures of glass, which is a great advantage, because this gall is the greatest enemy to the manufacture of fine glass.

6. That the pots, in which the glass is melted by means of sulphate of soda, must be made with much care, and with a different proportion of materials, because this glass attacks them much more than that made with pot-ash.

7. That sulphate of soda may be very well prepared by decomposing muriate of soda; and for this purpose the waste of vitriol

manufactories may be employed, which is a considerable saving.

8. Lastly, it is well known, that, when fine glass is made, and more soda or potash is mixed in it than in common glass, the glass, if not properly cooled before it is wrought, though at first very pure, begins soon to enter into fermentation while working, and afterward appears full of blebs. It is observable, that glass made with feld-spar containing pot-ash always abounds in blebs; yet it is possible to make good glass of it, and thus turn to account the pot-ash contained in it.

Experiments.

As the sentiments of Kreschmann, Pott, Laxmann, Gren, Lampadius, Van Mons, and Pajot-Descharmes, respecting the use of sulphate and muriate of soda in the fabrication of glass, differ widely, it was necessary to make the following experiments, to ascertain the processes that might answer.

1. First a mixture of quartz and sulphate of soda, in the proportions of 100 to 60, was made, and exposed to the fire of a glass-house furnace twenty-two hours. At the end of this time no vitrification had taken place, or at least it was imperfect, however high the heat was carried.

2. Quartz, sulphate of soda, and burnt lime, were taken in the proportions of 100, 100, and 15, and heated. A second mixture was made in the proportions of 100, 50, and 20; and a third in the proportions of 100, 54, and 17. The third mixture was heated in a furnace the fire of which was urged by bellows. At the expiration of four hours more vitrification had taken place, it is true, than in the first experiment; but the glass was very stiff, and as it were stony.

3. Quartz, calcined pot-ash, lime, and sulphate of soda, were mixed in the proportions of 100, 10, 17, and 43, and at the expiration of an hour and a half the result was the same.

4. Quartz, sulphate of soda, lime, and charcoal dust were mixed in the proportions of 100, 54, and 14, for the former three; and the charcoal was varied from 4 to 4·2, 4·4, and 4·5. These mixtures were left in the fire an hour, and a brownish yellow or

sometimes colourless glass was obtained, the colour always depending on the proportion of charcoal employed.

5. In the fifth experiment quartz was mixed with sulphuret of soda, obtained from carbonate of soda and sulphur heated together till no more sulphur was sublimed, in the proportion of 100 to 60.

6. In the 6th quartz was mixed with sulphuret of soda, obtained from eight parts of calcined sulphate of soda and one of charcoal dust, and lime, in the proportions of 100, 45, and 17.

7. In the 7th quartz was mixed with sulphate of soda, sulphuret of soda, and lime, in the proportions 100, 24, 24, and 17; and also in those of 100, 2·5 or 3, 45, and 17. The mixture was left in the fire an hour. These experiments gave the same result as the 4th. When these trials, and many more, the particulars of which it is unnecessary to recite, had been made, the process was attempted in the large way. The mixture was formed of 100 parts quartz, 54 sulphate of soda, 17 lime, and 5 charcoal. During the fusion, a shovel-ful of burning charcoal from the furnace was thrown in, the five parts proving too little in the circumstances that took place in the glass furnace. The general results of these experiments were:

1. That sulphate of soda may be employed in glass making, without any addition of pot-ash or of soda. The glass obtained by this process is as beautiful and as white as glass made with the usual materials, and has all the same qualities.

2. That the vitrification of sulphate of soda with quartz is very imperfect even in the strongest fire. It is more complete, if lime be added, but then it requires a great deal of time and fuel: and it is rendered perfect by the help of a substance, that decomposes the sulphuric acid of the sulphate of soda, and thus removes the obstacle, that prevents the soda from acting on the silex. The best medium that can be employed is charcoal, or for flint glass, metallic lead.

This decomposition may be conducted during the vitrification, or previous to it. The methods employed must be varied according to circumstances, but it is essential to observe, 1st, the pro-

perty charcoal has of colouring glass, even when in very small quantity; this property of charcoal not being exceeded by any of the metallic oxides hitherto known: 2dly, the preference to be given to lime reduced to powder, dissolved in water, and heated anew, before lime slacked in the air: 3dly the great effervescence of the glass when sulphate of soda is employed, an effervescence, however, not greater than sometimes arises from common soda; and hence the precaution that must be taken to add it in smaller successive portions, than if pot-ash were employed: 4thly, that the work must be carefully distributed in glass-houses of this kind, not to be troubled by this effervescence: 5thly, that sulphuret of soda may be more useful in glass-making than sulphate of soda: and lastly, care must be taken in preparing the pots, because the sulphate of soda has a particular effect, as every other flux has.

ON THE MANUFACTURE OF CHARCOAL.*

THREE brothers have established at Pellerey, near Nuits, Cote d'Or, a manufactory on a large scale, for making charcoal in close vessels.

The quantity of charcoal they obtained is double that of the usual mode, while it requires only one-eighth part of wood to be consumed in the distillation; it is also better than the common, as a given quantity evaporates one-tenth more water than the other; hence iron masters may obtain twice as much iron from the use of a given quantity of wood; and in addition to this there is also prepared a number of other articles, of each of which in order.

350 Chiliogrammes (700 *lb.*) of wood, yield 25 or 30 of tar, which retains so much acid that it is soluble in water; but when it is washed, and rendered thick by boiling for some time, it offers more resistance to water. If mixed with one-fifth of rosin it is

* From the "Retrospect of Discoveries," Vol. 6. London, 1811, p. 100. Originally published in the Annals of Chemistry, Vol. 66.

rendered equally fit for the use of ships, &c. as the common tar.

Four sorts of vinegar are prepared, all of which are perfectly limpid, which do not, like the common, contain any tartar, malic acid, resinous or extractive matter, nor indeed any mineral acid, lime, copper, or other substances. The simple vinegar marks—2° hydrometer for salts, at 12° centigrade thermo. it is stronger tasted than common vinegar, and produces a disagreeable irritation. The aromatic vinegar is prepared with tarragon, the smell is agreeable, but it has the same fault as the former. The vinous vinegar is formed by adding some alkohol to simple vinegar; it has a very sensible odour of acetic ether; the alkohol softens the flavour in some degree, but the vinegar is still very sharp. The acid, called strong vinegar, is in fact a very good acetic acid at $10\frac{1}{2}$° hydr., it is very white, clear, and sharp, without the usual burnt flavour, and seems to form the basis of the preceding kinds. It can be sold for 8 or 9 francs (7*s.*) per *lb.* which is only half the price of that distilled from verdigris. Although not so agreeable to the taste as common vinegar, these new kinds are more elegant to the eye, and do not mother.

Carbonate of soda, perfectly white and transparent, is made at this manufactory; the greatest part of this salt that is used does not require so much purification, and if the price will allow its being brought into use, 60 per cent. of the expense of carriage may be saved by drying it thoroughly before it is sent off.

The acetate of alumine that is prepared here is not sufficiently pure for the use of dyers, as it contains the sulphates of lime, and of iron, which last is very prejudicial in dyeing: but by using good alum in its preparation this might be avoided. This acetate is also turbid, and contains a white deposit probably of alumine, which ought to be avoided.

Acetate of soda in well formed, very white, and pure crystals. It is not of much use, unless physicians should substitute it in the place of acetate of pot-ash.

Acetate of copper crystallized in small grains, more brilliant than common verdigrease. It is entirely soluble in water, and much cheaper than that in present use.

Acetate of barytes perfectly pure; it would be preferable to acetate of lime for preparing acetate of alumine, if it were not too dear.

Muriate of alumine is said to be preferable to alum in dyeing, but that prepared by Messrs. Mollerat is excessively acid, and contains lime and oxide of iron, which renders it useless in many cases.

Oxide of zinc of a dirty white, and containing oxide of iron, and a little carbonic acid, which it appears to have absorbed after it was calcined.

Carbonate of zinc, rather whiter, but which also contains some iron, although the carbonic acid hides its colour.

Both the two last substances might be used by painters instead of white lead.

Besides the above, the proprietors intend to make white lead, and also sugar of lead.

A cubic metre (yard) of wood yields one hundred litres (quarts) of acid liquor, besides the above 25 or 30 chiliogrammes, (50 or 60 *lb.*) of thick oil.

Observations by the Editor of the Retrospect.—The proprietors of this manufactory seem to be perfectly aware of all the several productions which could be prepared from the refuse of their principal object; and we have no doubt but that the substances they procure in this manner will amply compensate them for the use of the capital that must be invested in building the furnaces. The nature of the vessels in which they distil the wood is not mentioned, but they are probably cast iron retorts, or vessels of a similar nature, in which a distillation *per latus* takes place. The application therefore of Lord Dundonald's furnaces for procuring coke to this purpose would be still more advantageous.

These furnaces may be seen in an early volume of the Repertory of Arts.

Ed. Archives.

STATE OF THE IRON MANUFACTORY IN GREAT BRITAIN.*

IN the year 1806, when the minister proposed to levy a tax upon the manufacture of iron, the owners of the 133 iron-works which then existed in Great Britain, deputed 14 of their number to assemble in London, and arrange the information which was submitted to the committee of the House of Commons, on the bill for imposing the tax, with a view of shewing its impolicy and ruinous tendency on a manufacture so essential to the success of almost all branches of British industry. It is through the kindness of one of these deputies that the following abstract of the iron furnaces which were working with coke or pit coal in Great Britain, in the spring of 1806, has been made public.

Cumberland has four works, containing four furnaces, all in blast; which make 1,491 tons of pig iron annually.

Derbyshire has eleven works, containing eighteen furnaces, of which only twelve are in blast, making 10,631 tons per annum.

Gloucestershire has two works, containing three furnaces, of which only two are in blast, making 1,629 tons per annum.

Lancashire has three works, containing four furnaces, of which only two are in blast, making 2,500 tons per annum.

Leicestershire has only one work, with a single furnace, which is now out of blast.

Monmouthshire has three works, containing three furnaces, all in blast, making 2,444 tons per annum.

Shropshire has nineteen works, containing forty-two furnaces, of which only twenty-eight are in blast, making 54,996 tons per annum.

Staffordshire has twenty-five works, containing also forty-two furnaces, of which only thirty-one are in blast, making 49,460 tons per annum.

Yorkshire has fourteen works, containing twenty-seven furnaces, of which only twenty-three are in blast, making 26,671 tons per annum.

* From the "Retrospect of Discoveries," Vol. 6. London, 1811, p. 100.

South Wales has twenty-five works, containing forty-seven furnaces, of which thirty-six are in blast, making 75,601 tons per annum.

North Wales has three works, containing four furnaces, of which only three are in blast, making 2,075 tons per annum.

Scotland has twelve works, containing twenty-seven furnaces, of which eighteen are in blast, making 23,240 tons per annum.

So that Great Britain contains in the whole 122 works, containing 222 coke furnaces, of which 162 are in blast, and make 250,406 tons per annum, being on an average 1,546 tons in each furnace.

There still remain eleven works in different counties, containing eleven furnaces, that still use charcoal, all of which are in blast, and make 7,800 tons per annum, or on an average 709 tons in each furnace.

From this abstract, it appears that the 133 furnaces at the period above specified produce 258,206 tons of crude iron annually, though only twelve years before the annual produce had been estimated at 100,000 tons. The number of furnaces out of blast or not working at the time, amounted to nearly one-fourth of the whole, and this circumstance is attributed in great part to the frequent repairs which the lining and hearth of a blast furnace require; and some had been blown out, or ceased to work in consequence of a temporary failure of their supply of either iron, stone, or coals, within the owner's or lessee's lands. The average produce of each of the 162 coke furnaces in blast, is 1,546 tons of pig iron. At Cyfarthfa, in South Wales, the average per furnace is as high as 2,615 tons per annum; while in 13 others the average quantity falls below 500 tons: at Dewey, in North Wales, it is stated at 150 tons only.

"The average quantity made at each of the 122 coke iron-works, is 2,070 tons per annum; seventeen of these works make 4,000 tons each or upwards; the seven largest are Cyfarthfa, in South Wales, 10,460; Old Park, in Salop, 8,359; Blackmour, in South Wales, 7,846; Pennydarran, in ditto, 7,803; Ketley, in Salop, 7,510; and Carran, in Scotland, 7,380 tons per annum:

while at the same time eleven of these works fall short of 500 tons in the quantity which they make. The three least of these are stated to be Golden Hill, in Staffordshire, 184 tons; Dutton, in Cumberland, 175; and Dewey, in North Wales, 150 tons of pig iron per annum.

Ninety-five thousand tons of this pig iron, manufactured in Great Britain, are afterwards rendered malleable. The capital employed in the manufacture of the raw materials only, is estimated at five millions; and it furnishes employment to 200,000 persons, independent of all the labour necessary to fabricate articles of iron."

Observations of the Editor of the Retrospect.—From the preceding summary it is evident, that the number of charcoal furnaces in this country has now become comparatively small, owing to the decrease of wood, and the consequent want of fuel for working them; though till about 40 years ago they were general in England, as they now are on the continent. In the reign of king James the first, this manufacture was in a very flourishing state in Great Britain; but from nearly that period the progress of cultivation became more rapid, which effected a diminution of fire wood, and a decline of the iron manufacture, as the necessary consequence. This decline was so great, that the advantages resulting from this branch of human industry were nearly lost until the process of making iron with pit coal was established, which has placed it upon such a permanent basis, that it is now capable of being extended to any magnitude without injuring the agricultural interests of the country; as the iron, though it produces so much, costs nothing that is otherwise useful, but the labour of its reduction.

In order to convey in a few words to such of our readers as are not acquainted with this subject, a general idea of the manner in which it is now conducted in this country, it may be observed, that a blast furnace of the common size, is charged 48 times, with eight bushels of coke each time, in the course of 24 hours. To produce this quantity of cokes, requires near 764 bushels of

coals per day. The furnace also consumes about nine tons of ore and limestone in the same time. The produce of metal obtained from this consumption is about 20 tons per week in summer, and 30 tons in winter, when making the best iron, or what the manufacturers call No. 1. Of No. 2, the quantity is from 35 to 45 tons per week.

At many iron works, three of these furnaces and their foundries are constantly in use; the coal and iron mines, with forges and rolling mills for making iron into bars, belonging to the same concern; the great number of steam engines, mills, waggons, horses, workmen's tools, frequently a railway or canal from one part of the works to another, a large farm to maintain the horses, and the capital necessary to prosecute such an undertaking, will give some idea of the opulence and general knowledge necessary to enable an iron master to conduct his business with advantage to the community, and profit to himself.

PAPERS ON RURAL AND DOMESTIC ECONOMY.

CORSTORPHIN CREAM.*

THE following agreeable preparation of milk is called by the inhabitants of Mid-Lothian, Corstorphin cream, from a village of that name, where it was probably first made. It is hawked daily through the streets of Edinburgh by the name of sweet cream. The process is as follows:

Take skimmed milk that has only acquired a moderately acid taste: put it in an upright wooden vessel, (an upright churn is commonly used) having a spicket and fosset at the bottom: place that in a tub, and pour hot water into the tub till it rises nearly as high as the milk in the containing vessel. Cover the whole with a cloth, to keep in the heat. In a few hours the milk separates into two parts; the upper part assuming the consistence of thick cream, that has very much the appearance of good cream, only moderately acid; the other portion that remains is a thin watery liquid, which is of a pungent acid taste, and may be easily let off by means of a spicket; this liquid is called wigg. The cream is then fit for use. No one would believe that it did not consist wholly of real cream that had stood till it became acid. Much of the goodness of this, however, depends upon the skill of the maker; as it is greatly affected by various circumstances, particularly the degree of heat to which it is subjected, and the acidity of the milk. It is eaten with sugar as a great delicacy.

TO MAKE A RENNET.

GIVE the calf half a pint of vinegar a short time before it is killed; take the curd out of the bag, and pick all the hairs out very clean, and salt the curd and bag separately. Let them lie

* Dr. Anderson's Recreations. London, 1800, Vol. 3, p. 346.

24 hours, turning and salting them again, then put the curd into the bag, and prick holes in it with a fork. Put on the fire a pint of white wine, with a handful of Bay leaves, some mace, cloves, and allspice; give it a boil, and then put in a clean stone pot, and pour the liquor over it. Tie it up close with bladder, and in two or three weeks it will be fit for use.

TO MAKE A CREAM CHEESE.

TO one pint of cream, add a teaspoonful of the above rennet, put the curd into a cheese vat, and take the whey well from it. When it is turned in the vat, put a little salt over it, and when the cheese is drying cover it with a few nettles or strawberry leaves.

By some, a cheese made entirely of cream is deemed too rich, and that a better way is to mix the night's cream with the morning's milk. A brick and a half is weight enough to press a cheese. Some persons ripen them in hay.

REMARKS.

The perfection of every aliment or preparation into which rennet enters, greatly depends upon the excellence of that article; for the slightest taint in it, will be communicated to the preparation of milk in which it is used. The above modes of making rennet and cream cheese, were communicated to the Editor by an experienced female economist.

TO MAKE CYDER WINE.

DURING an excursion in the course of last summer, for the benefit of that greatest of all blessings, health, the editor visited the village of the religious society known by the name of the *Shakers*, at New Lebanon, New York, and there tasted a very

pleasant liquor called by them *Cyder Wine;* the receipt for which was dictated by one of the brethren, and is as follows:

After the cyder is pressed, put the pummice into a tub or vat, cover it with water, and after it has fermented or is nearly done fermenting, press it again, then distil the liquor, add three gallons of the produce of one barrel of good clear cyder of the last running. The cyder must be made late in the season; and the new compound kept in a cool cellar, and bunged tight: it will work a little, but without injury to the liquor, which becomes clear and fine. It resembles the French Frontignan Wine.

TO MAKE ORANGE MEAD.

Communicated to the Editor by a friend.

Take of Honey, - - - - - -	68 lb.
Soft water, - - - - - - -	17 gallons,

Whites of 12 eggs, beat up with a quart of the above liquor, while cold.

Boil the whole for an hour, skimming it from time to time. Then pour the boiling liquor on the thin rinds of 1 doz. of Seville oranges, and cover it up. When it is about luke warm add the juice of 8 doz. of Seville oranges, and of 6 lemons and their thin rinds. Stir the whole well, and cover it till it is cooled down to 96° of Fahrenheit's thermometer, when a pint of good ale yeast is to be put on a toast, and added to it. After it has fermented two or three days, or till the froth begins to sink, then strain it off from the press into a clean cask, and let it stand 6 months before it is bottled. Draw it off carefully with a syphon, without disturbing the grounds.

TO REMOVE GREASE IN PAPER.*

SCRAPE finely some pipe-clay, the quantity of which may be easily determined on making the experiment: lay thereon the sheet or leaf, and cover the spot in like manner with the clay. Cover the whole with a sheet of paper; and apply for a few seconds, a heated ironing box, or any substitute adopted by laundresses. On using Indian rubber to remove the dust taken up by the grease, the paper will be found restored to its original degree of whiteness and opacity. J. EVANS.

Bristol Mercury Office,
Sept. 14, 1804.

The writer says, that he has often proved the foregoing simple method to be much more effectual than the use of turpentine: and once in particular, upon a folio of a ledger which had exhibited the effects of a stream of candle-grease and snuff for more than twelve months.

TO MAKE RICE BREAD.

[The following mode of making rice bread in South Carolina, is given by Mr. John Drayton, Esq., of South Carolina, in the 9th Vol. Repertory of Arts, p. 313.]

THE rice being washed and drained, is beaten to powder in a mortar: it is then taken out and completely dried, and finally passed through a hair sieve. The rice flour is kneaded up with a small proportion of Indian corn meal, boiled into a consistence termed *hominy*;* or it is sometimes mixed with a few boiled potatoes, to which a small quantity of leaven and salt are added. When the fermentation has been sufficiently excited, the dough is put into pans, and placed in the oven, to be baked. By this process, a light, wholesome, and pleasant bread is made.

* From the Monthly Magazine, London, March, 1810.

† To make hominy the corn must be only ground coarsely, and the outer husks or skins of the grain taken out. *Editor.*

TO BOIL RICE.

By the same.

THE rice being washed, is thrown into a small pot of boiling water, and boiled until the grains are softened, and nearly done. The water is then poured off; and the rice, covered up, remains in the pot to simmer, or more properly to steam, over a slow fire, until it becomes dressed to any required degree of dryness. The degree preferred in Carolina, is just when the glutinous quality of the rice ends, and before the desiccation begins.

REMARKS.

In order to have the rice for boiling as white as possible, it should be carefully picked (an operation which the common cargo rice generally requires) and washed in at least two waters. About one hour is required to boil the rice thoroughly; but the regularity and heat of the fire will make a little difference in the time. An unglazed earthen pipkin is the nicest utensil to boil rice in, and such are constantly used in the East Indies by the natives, who chiefly subsist on the article. An iron pot, however, answers well; but whatever utensil is used, it should be carefully *kept for that purpose solely*. Simple as the operation of boiling rice is, it is very seldom brought to table properly boiled, out of S. Carolina or Georgia. The above directions, if attended to, will always insure success. *Editor*.

TO PRESERVE FRUIT TREES, OR TO REVIVE THEM WHEN DECAYING.

THE fact of the utility of spreading refuse flax, or flax shaws, around fruit trees, has some time since been before the public,* and as every confirmation of it is important, especially

* Domestic Encyclopædia, article "Fruit."

when the delicious peach is in question, the following is given:

Sonini* says, that "the experiment has been tried on an old languishing peach tree with great success. Refuse flax stalks were spread at its foot, and far enough to cover all its roots; when it soon recovered, pushed out vigorous shoots, and was loaded with larger and better fruit than before."

ON THE FORM OF CHIMNEYS, AND ON PLASTERING THEM INSIDE.†

IT is the general and universal custom to make the funnel in a square or oblong form; which, on many accounts, is very improper. The corners of a square funnel, if ever so carefully pargeted and cleaned, contain a quantity of cold air: for the rarefied air, in its course up the funnel, never enters into them, as it always ascends in a circular form; therefore being square does not add to the width of the funnel, which, in strict truth, is only the inscribed circle. The air in the corners all the way up forming small eddies, are the occasion of the soot adhering and sticking there, which, by accumulating, forms into large knobs, and greatly retards the ascent of the smoke. These lumps occasionally detached, by frequently falling into the room, are very dangerous, by catching fire, and it is almost beyond the art of man to sweep them perfectly clean; on which account all funnels are best of a circular form.

The advantages attending a circular funnel are obvious. The air will ascend with the greatest ease and freedom; the soot will not adhere to the sides, nor will there be any vacuities for the cold air to hover about in, and it will be swept with the greatest ease. This is an object well worthy the serious attention and

* Bibliotheque Phisico—Economique, Sept. 1808, p. 161.

† From Clavering's Essay on the Construction and Building of Chimneys. 3d edition, London, 1793.

consideration of every gentleman concerned in building for his own accommodation.

The next article under this head is the pargeting, or plaistering the inside surface of the funnel, which is a very essential point; for if the inside of the funnel is not very smooth, the smoke will less or more be retarded: and where it is rough and ragged, the soot will adhere and stick to these parts, and there accumulate. The regular smoothness of the inside of the funnel greatly promotes and facilitates the ascent of the rarefied air and vapour, and lets them pass with ease and freedom to the top. It behoves gentlemen to be particularly careful that this precaution is not omitted. Workmen should have their pargeting, or plaistering, ready at hand, properly prepared with good materials, and lay it on always at a convenient height, that can easily be reached as they advance, and work it as smooth and even as possible. In the operation they should be very attentive to prevent any loose mortar falling down the funnel, from their trowel (which may easily be prevented by having a small piece of board underneath), as it will otherwise drop upon the bent part of the funnel, harden into lumps, contribute to choak the passage, and be attended with disagreeable consequences.*

Pargeting mortar, which is used for the inside of chimney funnels, ought to be made with care, in the following manner and proportion: To any quantity of the best and strongest lime, sifted fine, add one fourth part of fresh horse-dung, clear from dirt and straw: let them be well beat, and incorporated together, and used fresh made.

But we would recommend the following composition, as much preferable and more durable, if properly made, viz. To two bushels of good stone lime, add one bushel of fine drift gritty sand, and a like quantity of sea-coal ashes, or brick-dust: skreen them fine, beat and incorporate them together, for the first coat; and,

* By attention to this hint, the Editor cured a smoky kitchen chimney in his house, which had caused much inconvenience. Nearly half a bushel of mortar was chipped off of a projection in the lower part of the funnel.

when well set, put on the following for the second, or finishing coat:

Take fine white plaister (commonly called plaister of Paris) mixed with stale small beer, and work it well in a trough, or tub, to a due consistence: then lay on a fine thin coat of it upon the other, carefully worked in, and as smooth and even as possible. In a short time it will assume the hardness of stone, and a polish little inferior to marble. A funnel thus executed and finished, can never be the cause of smoke.

ACCOUNT OF A WELL FOR PRESERVING AND FILTERING RAIN WATER FOR DOMESTIC PURPOSES, WHERE A SUPPLY OF SPRING WATER WAS NOT EASILY TO BE OBTAINED.

From Nicholson's Philos. Journal, Vol. 22, p. 354.

TO MR. NICHOLSON,

SIR,

YOU may perhaps deem the following account of a filtering rain-water well, which has been successfully tried here by the Earl of Caernarvon, not undeserving of notice in your valuable Journal. His lordship has lately erected upon a dry gravelly eminence in his park, an ornamental circular building, consisting of a room and open colonades above, and apartments for cottagers upon the basement floor. Considerable discussion arose upon the mode of supplying them with water, from the depth to which it was necessary to sink, in order to obtain an effective well. My friend, Mr. John Loat, builder, of Clapham, who had furnished the plan for the construction of the dome roof, mentioned to me a contrivance of his father's to meet a similar difficulty, which had been attended with invariable success, and Lord Caernarvon immediately determined upon carrying it into execution.

Following Mr. Loat's instructions, we sunk two wells, 30 feet deep by 4 feet diameter each, which for greater perspicuity I shall call No. 1 and 2. They are a trifling distance asunder, and were

carefully clayed, to prevent percolation into the surrounding soil, and lined with bricks in the usual manner. A well secured communication was made between the two wells, by a small leaden pipe inserted two feet from the bottom. All the pipes from the roof were directed into No. 1; and an oak floor, bored full of small holes, and supported upon posts, was laid in at No. 2, just above the pipe of communication. Upon this floor was first placed a stratum of well washed coarse gravel, then one of finer, next a stratum of coarse sand, and finally one of the finest sand we could procure, making altogether two feet in thickness of silicious substances. The water, which is received into No. 1, passes through the leaden pipe into No. 2, and filtrates by ascent through the strata of sand and gravel, the space below the level of the oak floor in both wells, acting as a cespool, receives all sediment. The pump is of course affixed in the filtering well. Both wells are covered up, but plenty of air is admitted to them, through apertures made for this purpose.

You will immediately perceive, that the merit of this plan consists altogether in the filtration by ascent, with a competent space under the apparatus. The interstices of the sand are thus never clogged, and its power is preserved unimpaired for an indefinite period. The well fully answers its intended purpose, and the water is altogether excellent. I have been tempted to submit this statement to you from a persuasion, that there are few houses, which may not be made in this manner to supply excellent water in sufficient quantity for domestic consumption; and that situations abound, where the filtrating well may be resorted to with equal comfort and advantage.

I am, Sir, your obedient humble servant,

J. R. GOWAN.

Highclere, Newbury, Berks,
April 1, 1809.

*Observations by the Editor of the Retrospect of Discoveries.**

"The circumstance of the sediment remaining below the floor, and filtering apparatus, prevents it from being disturbed by the pump, and mixed again with the water.

"If we reflect upon the method which nature pursues in the filtration of water, we shall find that those waters that descend from hills, though passing through sand and rocks, are seldom pure; but that those are the most limped, which by ascending, ooze out near the foot of a mountain. The cause of this difference appears to be this: when the water descends through sand, the finest and heaviest of the particles descend with it, and gradually penetrate through the sandy strata; but on the contrary, when the water is forced to rise through sand, in order to make its escape, all such ponderous ingredients, by reason of their greater specific gravity, are left behind and settle at the bottom. The lighter particles of fluid, therefore, remain in the upper strata in both cases."

The well described above being formed upon these principles, and all filtering machines constructed in the same manner, cannot fail of fully answering the purpose intended by them. The plan will be found extremely useful in situations where rain water is preferable to well water, or where the former must be had recourse to in consequence of the depths of springs. *Editor.*

* Vol. 5, p. 172, and vol. 6, p. 491.

PAPERS ON AGRICULTURE.

ON THE CULTURE AND CURING OF MADDER.

BY MR. ARBUTHNOT.

From Transactions Dublin Society, Vol. I, part I.

IF it is required to establish a plantation of Madder, to which plants must be brought from a foreign country, they must be winter plants, which are pieces of the main root on which are many buds; these are to be had in the latter end of autumn or spring, when the crop is taken up. The best method is to pack them in sand, as the buds will shoot; the ground should be extremely rich, a sandy loom, and perfectly clean; furrows should be made about a foot asunder and about four inches deep; strew the pieces of root and any of the yellow shoots, that are broken off, just sufficiently to cover the bottom, and earth them. In the month of April there will appear numberless shoots, which should be kept very clean, and a little fine mould thrown over them to lengthen the stem, which are the spring plants; when the shoots are about six or eight inches above ground, they are fit to draw, but care must be taken to pull them up with as long a stem as possible, as that becomes the principal part of the crop; the earth must be loosened by an old trowel or any such like instrument to facilitate the drawing of the plants, but it must be done with care, as in a few days time there will be a fresh succession of plants like asparagus. The above are merely directions for the nursery, which may be dug up for crop when all the plants are obtained; for the repeated pulling will so weaken the roots, as to render them not worth standing for crop; for want of this precaution many people injure their crop by drawing plants from it, instead of planting a small patch as above described for a nursery.* It must likewise be observed, that you will obtain the longest and best plants from the first

* One acre of good madder will yield plants enough for ten acres. Martyn's edition of Miller's Gardeners' Dictionary. *Editor.*

year's growth, as the original plant or mother root is much deeper, than the crowns of the plants will be by earthing.

The land for the crop should be, as for the nursery, a rich mellow loam, either hazle, or black; it cannot be too rich, and must be perfectly clean; it must be ploughed as deep as the good soil will admit of the preceding year of planting. Soil, that will not admit of ploughing eighteen inches deep at least, is not fit for madder. It must be laid up in high four feet lands before winter, that it may be sufficiently dry for working in the spring; for unless the land is in exceeding good tilth when you plant, it is in vain to attempt it.

The land should therefore have one good ploughing in the spring, partly to destroy any weeds which may have grown during the winter, as likewise to enliven the soil, but it must be when the land is perfectly dry: as soon as your plants are ready, which will be in April,* slit down two furrows one foot asunder from the crown of the land; then lay the plants against the sides of the furrows about six inches asunder, with their heads leaning to each other; this operation may be performed by women and children, who are followed by men, who with hoes cover the plants with the mould that was thrown out by the plough. Unless it is rainy weather when your plants are drawn, they should be dipped in water the moment they are pulled, and kept quite wet till planted; and, if the land is dry, it will be requisite to give a good watering the evening of the planting; for, as the plants are extremely succulent, in that proportion they dry up the faster, and will shrink to the size of a straw. If the plants do not strike immediately, they are not worth standing; they are in the greatest perfection for pulling, when small fibres begin to push all around them. As soon as you perceive, that the plants have struck vigorously, hoe the ground well round and between them,

* The American reader should recollect that this refers to the climate of England. Mr. Arthur Young says, that "though two rows on a four foot land, amount in the whole to the same as equally distant at two feet, yet they do not near equal them in product." Eastern Tour, Vol. 2d. p. 263 to 328.

Editor.

so as to loosen the soil well, and make it perfectly pervious to the young fibres; as it is the vigour of the first year's growth, which is to secure you a plentiful crop. After this operation you are only to take care, that no weeds grow during the summer, which must be by hand-weeding, and superficial hoeing; for the roots, which are the crop, must be carefully preserved from injury; therefore great care must be taken to watch and destroy moles, which always frequent rich land in search of worms, which they feed on. When weeding and hoeing the crops, draw a little light mould from the sides of the land to nourish the crowns as much as possible. In autumn, when the haulm dies, cover the whole over three inches deep, to preserve the crowns of the plants from frost, and the haulm rotting in the ground is beneficial, and keeps the ground loose; this earthing must be done from the intervals, which consequently should be occasionally worked with a light plough or horse hoe during the summer. Open the water furrows well against winter, that no water may lie. As early in the spring as the weather will permit, the whole plantation should be carefully weeded over, but great attention must be paid to the not destroying of the buds, which will be near the surface waiting for warm weather to push. Such land as I describe, being made rich, will be very subject to chickweed, and if it is not checked in time it will greatly smother the crop and exhaust the moisture from the surface of the soil. The remainder of the second year's practice should be as the first, respecting hand-weeding and slight superficial hoeing, and earthing on the haulm in autumn; indeed the more you can earth the plants in the time of growing the better, as it will produce a greater quantity of roots; but each year, you must be more careful in not disturbing the sides of the lands, as the shoots will run like asparagus; thus at last you have only a deep furrow between the lands. Some people take up the crop the second year, but I prefer three years growth: the great expense being the preparing the land, planting, and taking up the crop, I have ever found the third year pay largely for the rent and tithes; the labour of hoeing is the least, and not necessary to be so very minutely attended to, though

large weeds must not be suffered to grow. The Dutch take it up at two years old, which from their mode of planting is right; they plant very thick on beds, from which circumstance their plants cannot come to any size. But I disapprove of that method, as it is the interior part of the roots, which produces the valuable madder, consequently the larger the root, the greater is the proportion of the best quality. I have traced the age of some Turkey roots to fifteen years old; they were become a solid wood all of the best quality; these must have grown wild.

The general practice of taking up the crop is by the spade. I did it with a large plough, which struck a clean furrow of above twenty inches deep; men, women, and boys followed the plough, and threw out the roots. The dirt should be shook out of them as much as possible, then carry them every day out of the field to be dried in the shade; when perfectly dry, most of the remainder of the dirt will shake out, first beating the roots to pieces with poles or flails. They must then be dried on a kiln.*

The madder must be frequently turned, and will be dry enough for grinding in twenty four hours. The first time, that it goes under the stones, requires but a few minutes; it must be sifted, and produces a very inferior species, which is the outward coat or rind. The remainder is returned to the stones, and is kept there till the eye tells you that the interior part begins to grind, which discovers itself by the paleness of the colour. If you require the best sort to be very fine, you continue this second grinding a little longer, in short till all the rind is pulled off; it must be then sifted, and the remainder put again under the stones and ground till fine enough for use. Each sort should be casked up separately, and kept in a dry place where no moisture can affect

* Mr. Arbuthnot's kiln was thirty feet long, with numerous flues on each side, to let out the heat and moisture from the drying roots. But it is highly probable that in the United States, particularly in the southern states, a few days exposure to the sun and air would dry them sufficiently. It is probable that they would require to be covered from the dew at night; and boards ought always to be at hand to protect them in case of rain. On this head, however, let the directions of the late Mr. Lucock be consulted. *Editor.*

it; care should likewise be taken to press the madder well down in the casks.

There are various sorts of madder, differing greatly from each other both in appearance and value. The sort I prefer is the Turkey, being more vigorous, and of a darker green. It likewise produces abundance of seed, which the common sort does not; it puts out many vigorous and solid runners, whereas the runners of the common species are hollow, and produce none of the best part of the madder, which is contained in the woody part of the root.

My mills consisted of two vertical stones, that run on a bed stone, such as they use for grinding gun-powder, dye woods, &c.

AN ESSAY ON

SOAP-ASHES, AS A MANURE.

IT has been found, that the produce of soap-ashes in London, and its immediate neighbourhood alone, amounts to above 20,000 tons annually, and is likely to increase, more especially from the use of *kelp* having been lately introduced into the London markets. The BOARD of AGRICULTURE having been convinced, from the most accurate information, and from experience, that this quantity of valuable manure if brought into more general use, would be an object of very considerable importance to the national agriculture, ordered an abstract of their REPORT, on this subject, to be printed and circulated; being desirous of giving all the publicity possible, to a circumstance so well deserving the attention of *farmers*, *gardeners*, *hop-planters*, *nursery-men*, and others employed in the cultivation of the soil, more especially those in the vicinity of the metropolis, and on the borders of navigations therewith connected.

This abstract of the Report of the Board of Agriculture, published about four years since, having been widely circulated, and much considered, has deservedly attracted the notice of agriculturists in general, and has induced them to make a variety of ex-

periments with soap-ashes, on different soils, and for different crops. Many highly interesting communications, on this subject, having been made to us, we conceive it to be a *public duty* to render them more permanently useful, by publishing in a condensed, but popular form, the important facts which they contain.

This is the object of the present essay. We shall consider the subject under the following heads.

1. *The Nature of soap-ashes.*
2. *Analysis.*
3. *The soils on which soap-ashes may be used with advantage.*
4. *The quantity per acre.*
5. *The crops for which soap-ashes are used, and the manner of applying them.*
6. *The Price.*
7. *The effect of soap-ashes on grass and arable lands, in parks, gardens, &c.*

SECT. I.—NATURE OF SOAP-ASHES.

Soap-ashes differ very materially in quality, according to the sort of alkaline salt which is used by the soap-boiler. When *kelp* and *barilla* are the materials, the ashes are found to possess twice the strength and effect of the refuse of common potash. Much kelp being *now* used by the *soap-manufacturers in London*, their ashes are greatly improved as a manure; as they contain a larger quantity of neutral salt, sulphur, and carbon, than when barilla only was employed. To this circumstance, we must attribute not only the different quantities per acre that are recommended, but also the different results which have attended the use of this dressing, in various parts of the kingdom.

Soap-ashes afford a much *cleaner* manure than *dung*. A dunghill, after laying for some time, is covered with weeds; and, in using dung, the farmer generally introduces almost every sort of weed into the ground. A heap of soap-ashes is never covered with weeds, but with a *fine sweet grass.*

Some ill-founded prejudices having been formed against the

use of soap-ashes, on account of their *supposed* burning quality, a statement of the following fact, will, we think, completely eradicate them. When a piece of ground has been covered, for a length of time, with soap-ashes and dung, the verdure is naturally destroyed. Those parts of the ground on which *soap-ashes have been laid*, recover their verdure *first*, and bring up sweet grass and white clover.

In *East Lothian*, in North Britain, the farmers are very careful in collecting all the kelp weed which is cast ashore during the winter, and which they lay in heaps, upon their lands. *This is using soap-ashes in another way*. In the neighbourhood of Dunbar, where the farmers use soap-ashes, as well as the kelp weed, they pay as high a rent as *seven pounds* per English acre, for very considerable tracts of land; which are principally cultivated with wheat.

SECT. II.—ANALYSIS.

Soap-ashes contain lime partly saturated by carbonic acid from the barilla or kelp; a portion of alkali; neutral salt; sulphur; carbon; silex, and calx; each, separately, of the utmost importance to land. According to the more minute analysis of Dr. Davy, the ashes from barilla contain 91 parts in 100 of carbonate of lime, and quick-lime; and carbonate of soda. The ashes from *kelp* contain calcareous matter, in the same state as that from barilla; gypsum; and soluble saline matter, containing, apparently, nearly the same proportions of carbonate of soda, and of common salt, as in the former instance.

It is obvious then, from the chemical nature of soap-ashes, that they will be applicable wherever calcareous matter is wanted in lands, and that they will serve the purposes of *liming*. Soap-ashes are, indeed, much superior to quick-lime as a manure.

A very respectable farmer in Holderness, Yorkshire, has affirmed, that he found *ground chalk* very superior to quick-lime; this, however, from the expense of grinding it, he was obliged to relinquish. The soap-ashes and the chalk holding carbonic acid,

and the lime being deprived of it, afford a convincing proof of the superiority of soap-ashes as a manure. The alkaline salt and gypsum that they contain, will render them much better than common calcareous matter, as a top-dressing to every kind of grass.

SECT. III.—THE SOILS ON WHICH SOAP-ASHES MAY BE USED WITH ADVANTAGE.

Upon all *strong and cold soils*, soap-ashes will prove of infinite service, whether applied to the wheat crop or to cold wet pastures, particularly in Surrey. Upon the lighter loams, it is an excellent manure mixed, and in a moist season, its effects are quickly visible and permanent.* Of all the manures tried on *peatmoss*, soap-ashes answer the best.†

Soap-ashes used in *cold*, *wet*, *spongy*, meadow-land, have apparently dried it, and by the salts they contain, made it produce much greater crops of grass than before.‡

They are found very good and durable, in Lancashire, on *dry pastures*.§

On a *clayey loam*, somewhat brashy, and particularly on *cold wet pastures*, soap-ashes have been used with great success.||

Poor clay land. Soap-ashes laid on this soil, will form a *marle*. Some of the worst land of this sort, has been rendered rich and productive, by the use of this manure.

On thin, sandy, and hot and gravelly soils. It is no less remarkable than true, that soap-ashes used in these soils, will make them more firm, enrich them, and will be found to answer much better than stable-dung. Those who have never used soap-ashes have erroneously supposed, that they are not fit for dry and hot soils. This, however, is a sad mistake. Soap-ashes, like lime or salt, are, in their nature, a very cold manure, but a very rich

* Malcolm's Compendium of Mod. Husb. vol. iii. p. 177.

† Wight's Husb. Scot. vol. iii. p. 184.

‡ Bath Papers, vol. i. p. 133.

§ Lancashire Report, p. 127.

|| Communications to the Board of Agriculture, vol. vi. pp. 324, 325.

one in production. The effects of this manure will be seen by the farmer for *seven years* after it has been laid on the ground, if used in the same quantity as dung; while the latter would be more exhausted in *three years* than the former would be in *seven.*

Soap-ashes applied to *light sandy land*, operate as a binder, on account of the quantity of lime which they contain. Lime descending considerably below the surface of the earth, in consequence of repeated rains, a *bottom* is formed, and other manures are better retained. Several *liberal dressings* with soap-ashes will be required to form a good bottom; and, indeed, some time also, as most farmers use them and dung alternately.

In addition to these numerous testimonies, may be adduced the authority of that experienced mineralogist and chemist Mr. Kirwan, who considers soap-ashes to be an excellent manure.*

These ashes will prove highly beneficial to soils abounding with undecomposed vegetable substances; as, upon these, the alkaline salt will act powerfully. A confirmation of this fact may be found in the advantage resulting to peat-moss, and low spongy meadows, from the use of soap-ashes.

SECT. IV.—QUANTITY PER ACRE.

From *one hundred to one hundred and sixty bushels.*†

Mortimer, in his Husbandry, directs eight cubical yards per acre.

Mr. Arthur Young recommends *sixty* bushels per acre, to be harrowed in with turnip-seed.‡

Six loads per acre, on wet grass land.§

Seven loads per acre, on wet lands,|| the immediate effect wonderful.

* Essay on Manures, p. 18. *Seventh Edition*

† Donaldson's Mod. Agr. vol. ii. p. 228.

‡ Eastern Tour, vol. i. p. 292.

§ Commun. Board of Agr. vol. vi. p. 324.

|| Ibid. pp. 324, 325.

Ten loads on poor loamy land, the effect very great.*

One hundred and fifty bushels per acre, on arable land, ploughed in with seed.†

It is not surprising that there should be some slight variation in these quantities; it is not more than occurs every day in the accounts we receive of other manures. There must, of necessity, be a variation, in proportion to many circumstances, particularly the quantity of the ashes used; but above all others, the difference in the soils upon which they are spread, must occasion a diversity in the quantities established by practice. Great attention should be paid to the *age of the ashes*, as some farmers have kept them a year, and some have used them immediately. The London ashes being mostly of the same quality, a certain quantity per acre might soon be established.

SECT. V.—CROPS FOR WHICH SOAP-ASHES ARE USED, AND THE MANNER OF APPLYING THEM.

Wheat.—Mr. Mortimer, in his Husbandry, says that *six crops* of wheat running, have been taken, after eight cubical yards of soap-ashes per acre, have been laid on.

By the assistance of this manure, the ground will not only yield a large crop, but may be sown constantly, without fallowing for many years together.‡

Soap-ashes are frequently employed as a *top-dressing* to wheat, in smaller quantities than when applied to pasture, and to great advantage. They are very frequently used in Berkshire.§

In the Memoirs of the Philadelphia Agricultural Society,|| it is stated, that soap-ashes answer best for clover and Indian corn, for *wheat* and *rye*. They are used in an open fallow, put on at

* Memoir of M. L'Hommedieu, in the Transactions of the Agricultural Society of New York, vol. i.

† Memoirs of the Philadelphia Agricultural Society, vol. ii, p. 105.

‡ Bath papers, vol. ii. p. 75.

§ Commun. Board of Agr. vol. vi. p. 323.

|| Vol. ii. p. 105.

the time of seeding, and ploughed in with the seed; and have been put on after the grain has been sown with very great success, but the other method is preferred.

Barley.—When soap-ashes were harrowed in with barley-seed, the benefit was plainly visible.*

Grass Land and Clover.—One half of a field of clover was top dressed with soap-ashes: the dressed part of the field produced double the quantity of *hay* obtained from the other.†

In Gloucestershire, they are much approved for low meadows over-run with aquatic weeds. They improve the herbage, and produce abundance of white clover.‡

Dr. Cogan, formerly of Bath, observes,§ that many persons use soap-ashes in a compost, and that in various quantities. One farmer tells me, that it is often used with *road earth*, in the proportion of eighteen loads of the ashes to thirty of the earth per acre, laid on *pasture land* in the spring; but the following very interesting account will evince that the *above precaution is not necessary nor advantageous.* It was transmitted to me by a plain, sensible farmer. I shall state his practice in his own words:

"My experience of soapers' ashes is confined to the application of it as a top-dressing on pasture land. About twelve years ago, I agreed with a soap-boiler for 1,500 tons of soapers' ashes; I then agreed with an hallier, to deliver it on my farm. I used to apply about *twenty* wagon loads per acre, and a single bushing would let the whole in. I was laughed at and abused by every body for my folly,—these wiseacres alleging that my land would be *burnt up for years*, and totally ruined, &c. &c.; all which I disregarded, and applied my soapers' ashes EVERY DAY IN THE YEAR, Sundays excepted, reeking from the vat, without any mixture whatever.

"I tried a small quantity (say six acres) mixed up with earth;

* Young's Eastern Tour, vol. i. p. 292.

† Bath Papers, vol. i. p. 133.

‡ Rudge's Gloucester Report, p. 272.

§ Commun. Board of Agr. vol. vi. p. 328.

but I found it was only DOING THINGS BY HALVES, a practice I never could adopt.

"In defiance of all these prophecies my land NEVER BURNED; but from the moment of the application, became of a dark green colour, bordering upon black, and has given me sometimes more, but never less, than two tons per acre, *ever since*, upon being *hayned* (*kept up*), 42 days, viz. in May and June. The ground I so dressed was twenty-four acres: and I have had one hundred and twenty sheep (hogs of the new Leicester breed) in the ground from August last to this day, (March 2,) but I always allowed them plenty of hay. And although they were culled in August, as the *worst* I had, out of seven hundred lambs, and selected for *this* ground, on purpose to *push* them, they are now as good as the best I have."

In the communications to the Board of Agriculture,* it is stated, that in Berkshire, soap-ashes are applied to coarse, wet, grass land, in the quantity of six loads per acre, UNMIXED, with astonishing effect. The value of this manure is well known in the county of Berkshire.†

Turnips.—When soap ashes were harrowed in, at the rate of *sixty bushels* per acre, with turnip-seed, the use of them was extremely apparent; the turnips were much better than where no manure was laid.‡

This important fact is further confirmed by the practice of R. Moate, Esq. near Watford, who found precisely similar effects to result from the use of soap-ashes.

We do not hesitate to affirm that a better manure cannot be used for turnip-ground, as nothing so much promotes their growth. Soap-ashes are an effectual preventative for the *black fly* which devours all before it, and which attacks the turnips in dry weather, while they are coming up. When rain falls, this manure forces the growth of the turnips. If the ground be sown

* Vol. vi. p. 323.

† Berkshire Agricultural Report, p. 363.

‡ Young's East. Tour, vol. i. p. 292.

with wheat after the turnips are eaten or drawn off, an abundant crop will be produced. If turnip-seed be steeped in the liquor in which soap-ashes have been infused, it will be an effectual remedy for the *fly*.*

In August last (1811), a gentleman in Hertfordshire, sowed a close of seven acres with turnip-seed, six acres of which he had previously manured with soap-ashes. Although the seed was put into the ground in a bad time, the six acres produced an excellent crop of turnips; while the single acre which was NOT manured with soap-ashes, afforded no turnips that came to maturity: the few that did come up, were soon destroyed by the black fly and wire-worm.

Potatoes.—Mr. Townley, of Lancashire, tried soap-ashes as a manure for potatoes, and found the effect very great. Ground which had NOT been manured, produced one hundred and thirty-four pounds; that which HAD been manured with soap-ashes, yielded *three hundred and eighty-three pounds*.†

Mixed ashes.—Notwithstanding what has been said respecting the use of soap-ashes UNMIXED, some farmers who are in the habit of making composts may think proper to use these ashes as a material in forming these heaps, and so far as earth is concerned, there can be no objection to the practice. When these ashes are applied to *arable* crops, it seems advisable to sow and harrow them in, previously to sowing the seed, which will prevent the action of any caustic quality on the germination of the young plant. The same circumstance will point out the *autumn* as the proper season for applying them on grass lands, though experiments may be tried with them early *in spring*.

Soap-ashes are eagerly sought after at Liverpool, Hull, &c.; where they are usually mixed with pond, ditch, and river mud, and used in about four months afterwards. This, also, was the method pursued by Robert Thornton, Esq. of Clapham, who

* Transactions of the Society of Arts, &c. vol. v. p. 47.

† Farmer's Magazine, vol. iv. p. 56.

used ashes for several years, and thereby greatly improved a very *sour pasture.*

In Cheshire, soap-ashes are usually *ploughed into the land.*

The following is the quantity of *mixed* ashes per acre, used in Surrey.*

Upon strong loams for *wheat*, ten to twelve cart loads.
Upon light loams for ditto, eight to ten ditto.
Ditto. . . *barley*, six to eight and ten ditto.
Ditto. . . *turnips*, six to eight ditto.

SECT. VI.—PRICE.

The price of soap-ashes, when introduced from Flanders about two hundred years since, was as high as *three* or *four shillings* a load.

About thirty years since, soap-ashes were imported into Liverpool from Dublin; but such is uow the increasing value and extensive use of this article, that they are all used in Ireland.

In the year 1777, the Essex farmers would readily give from *twelve shillings* to a *guinea* for a waggon load, and fetch it five or six miles, and find their account in so doing.†

At Hull, ten years since, the soap-makers *paid for having their ashes taken away;* they are now sold for *twenty-four shillings* per cart load.

At Ipswich, *twenty-five shillings* per cart load, besides carriage.

In Suffolk, where the soap-makers are farmers, they will never sell any.

SECT. VII.—EFFECTS, *See also* SECT. V.—CROPS.

The various effects on different crops, will be noticed in the following order:

Wheat.—Mr. Thorne and Mr. Knivett, two principal farmers near Ealing, have used soap-ashes on *arable* land, with great success and advantage. They have taken the produce of one

* Malcolm's Compend. vol. ii. p. 177.

† Bath Papers, vol. i. p. 133.

large soap-house between them for several years. These ashes produce clean crops, with neither smut nor weeds; and not only effectually destroy, but also prevent, the approach of the *wire-worm* and *slug*, which are so injurious to wheat.

From *thirty-five* to *forty* bushels of corn, per acre, have been taken off land that had been ashed, and had produced a crop of wheat, and two crops of clover; and, that without any other help than a *single dressing of soap-ashes*. The land was so poor before, it could not have produced five bushels per acre.*

M. L'Hommedieu, in a memoir, presented to the Agricultural Society of New-York, states, that *ten loads* of soap-ashes on poor loamy land, will, in general, produce *twenty-five* bushels of wheat, per acre, which defrays the expense of raising the crop by more than one half. The land is then left in a state for yielding a crop of hay, containing from one and a half, to two tons of hay per acre, for several successive years.

Grass and Clover.—Mr. Sherwood of Abbot's Langley, has used soap-ashes with very great success, when mixed with composts.

Mr. Mansfield, near Epping, had a poor sour pasture, that would not mow, nor would stock eat it; a total change was effected by the use of soap-ashes. The soil was strong, wet, and heavy.†

Lord Suffolk, a member of the Board of Agriculture, possesses a grass field in Wiltshire, which was manured with soap-ashes nearly twenty years since, and the improvement was very great, and has continued so ever since. A line may be now drawn where the soap-ashes were used.

Robert Thornton, Esq. of Clapham, in some experiments on very sour bad pasture, amounting to seven acres, found that these ashes added one load of hay, per acre, to the crops. It produced a sweet pasture bottom, with white clover.

Mr. Packman, of Rainham, in Kent, had a sour and coarse

* Memoirs of Philadelph. Agricult. Soc. vol. ii. p. 105.

† Essex Agricultural Report, vol. ii. p. 246.

pasture; the sheep would not eat, and always had the *rot.* This pasture having been well manured with soap-ashes, produced good and sweet herbage; and the sheep became as healthy as any in the county.

In Berkshire, Mr. Billingsly says,* he has applied soap-ashes on very coarse, wet, grass lands, in the quantity of *six* loads per acre, *unmixed*, with an astonishing effect. The rushes disappeared, and gave place to a luxurient crop of trefoil; and the benefit was so obvious, *three or four years after the application*, that the eye could trace the line of separation. He pronounces these ashes to be much superior, in such cases, to every other manure.

Another gentleman says,† "on pasture ground inclined to be wet, though not sufficiently so as to require under-draining, I have seen the effect to be very striking, particularly in the *second year.* I am convinced that wet lands are preferable from the following fact. I once covered four acres of upland with these ashes, about seven loads per acre. The immediate effect was wonderful. The grass grew famously, and I cut, certainly, thirty-five hundred weight of hay, per acre; the grass came on equally well. The best time of hauling out is, evidently, when the ground is open, and the rain does not fall in such torrents as to wash it away."

A Gloucestershire correspondent, in the *Farmer's Journal* for March 30, 1812, narrates some interesting facts respecting the use of soap-ashes on old, worn-out pasture land which are a strong confirmation of the circumstance related in pp. 289–90. This correspondent observes that it is now *sixteen years* since he completed the dressing, and that this piece of land is, at the present moment, the best in the parish. He also advises the *draining* of the land before the soap-ashes are laid on. This, of course, applies only to such lands as by their excessive moisture, require the operation. The correspondent was rewarded in the year 1797, by the *Bath and West of England Society* with a pair of goblets.

* Commun. Board of Agr. vol. vi. p. 323.

† Ibid. pp. 324, 325.

Soap-ashes used on *sour pasture land*, will produce more hay or pasture than any other manure; and are equally good for dressing upland grass. If laid on in winter, this manure will produce a large crop of hay in the following summer, and will afford a greater quantity in a subsequent year. It will also destroy the COUCH GRASS, by rendering it easy for the farmer to throw out the roots.

A better article than soap-ashes cannot be laid on *clover*, in winter, and early in spring. This manure is double the value of *coal-ashes*, and will not cost half the money. Coal-ashes are not only very dear, but much inferior in quality, compared with what they were formerly. This arises, in some measure, from the immense quantity of bricks made in the vicinity of London. All the coal-ashes that can be procured, are sent to the brick makers, who pay a great price for them, and the farmer gets mere sand and dirt. If the farmer would once use soap-ashes, he would buy no more coal-ashes; for the former will not only improve his crop of clover, but greatly increase the wheat crop after the clover.

It should be particularly remembered, that the effects of soap-ashes will not be so evident in the first, as in subsequent years; and that these beneficial effects are not sudden and temporary, but certain and lasting.

Kitchen Garden.—No gentleman or gardener, who wishes to see his plants flourish, should be without soap-ashes, if he can obtain them. Where they have been freely used, they will destroy all vermin, and prevent *moles* from turning up the ground. These ashes will entirely eradicate the *grub*, which gets into the root of young cabbages, and occasions the CLUB ROOT,* or large botches and warts. This destructive evil, which greatly impedes

* Prefixed to the pamphlet are two coloured plates of Brocoli roots; one taken from one-half of a bed well dressed with prepared soap-ashes: and which bed produced fine healthy plants, with very few weeds. Another plate representing a root from the other half of the bed, dressed with dung: four out of five plants were affected by the club root, and thrown away; being in a fungous state. The bed was also full of weeds. *Editor.*

the growth of cabbages, cauliflowers, brocoli, &c. is never seen where soap-ashes have been used in proper quantities. They prevent weeds, and improve the vegetables in flavor.

Peas and beans, in fields and gardens, will be completely protected from the devastations of *rats* and *mice*, by the liberal use of soap-ashes.

Worms and Slugs.—In gardens where dung is profusely employed to force crops of *lettuces*, *radishes*, *onions*, and the like, those crops are very often destroyed by grubs and wire-worms. Were the gardener to lay up his dung in a heap, and cover it over with an equal quantity of soap-ashes, and let it remain for a month or six weeks, mixing it well together, he would have lettuces early, and of a large size, which would not be injured by worms and slugs.

Snails.—A gentleman at Fulham, who had taken great pains in cultivating a large kitchen garden, was greatly pestered with snails; so much so, that he had collected a bushel in a morning, and could not keep them under. This evil was to be attributed, in some measure, to a quick-set-hedge, which separated his land from some adjoining grounds belonging to a market-gardener. Soap-ashes were spread on a strawberry border, next the hedge; and, in twenty-four hours, there was not a snail to be seen on the border, or in the hedge. These enemies to vegetation did not return that summer or autumn; and, by occasionally using the soap-ashes, the ground is now entirely freed from snails in the most wet and hot seasons.

Wall Fruit.—If the snails are carefully picked off the wall fruit, and a quantity of soap-ashes spread on the border, under the wall, the snails will never travel over them. At the same time, an excellent manure will be provided for the borders. The truth of this statement may be easily ascertained. Place a snail upon a few of the soap-ashes; it will immediately quit its shell, and perish.

Plants.—Limed soap-ashes have a strong attraction for carbonic acid, which they separate from the atmosphere, and thus render an important service to plants. These ashes also absorb,

with avidity, the night dew in hot weather, and furnish moisture for vegetation during the day. The following singular instance will illustrate this remark. At Marble Hall, (Surrey) some soap-ashes were, accidentally, placed round the trunk of a poplar tree, to the height of four feet, and remained in that situation, for the space of three years; on removing the soap-ashes, it was discovered, that *seven new roots* had struck into them, from the trunk of the tree.

Gravel walks.—Soap-ashes laid three or four inches in depth previously to putting on the gravel, will bind the walk, render it hard and firm, and effectually prevent the worm from working through.

Parks, Inclosures, &c.—Soap-ashes have been used with much success in parks and meadows. For *lawns* they are excellent, as they produce a close, thick, clover bottom. Steeped in water, they will destroy the worm in lawns. Manure being so very scarce, they are particularly applicable to new inclosures.

Conclusion.—What an advantage would it be, if, instead of being sparing of manure, farmers would endeavour to increase their number, and to render them more beneficial, by employing them in a more effectual manner. Were this part of rural economy better attended to, and more carefully considered, we should see many places in a state of cultivation, which, on account of the bad quality of their soil, have, hitherto, resisted all our labours to render them fertile.

The expense of *rent and taxes* to the farmer, is always the same, whether his crops be large or small. How important, then, is *manure!* but, infinitely of more consequence is it, to possess a manure, which will last for a long time, and be reasonable in price. If the farmer obtain this manure, (and by using soap-ashes he will obtain it) both expense and time are saved; and crops that would scarcely pay their own charges, are made abundant and profitable.

A good dressing of soap-ashes will last in the land, three times as long as a dressing of dung.

REMARKS.

The Editor is indebted for the above essay to the author, an attentive correspondent in London. The utility of leached ashes as a manure, is well known in New Jersey and on Long Island, and by a few farmers in the vicinity of Philadelphia. The price of a single horse cart load at the soap boilers is $\frac{2}{3}$ of a dollar; it is then carted to the wharf (if destined for New Jersey, and put on board sloops and flats, and taken to the landings up and down the Delaware, and thence hauled as far as seven miles by the farmers. Great quantities are also taken to Long Island every winter, and much of the improvement there in the lands, and in those of New Jersey, has arisen from the use of this article. Three years since the Editor was informed by Mr. A. Taylor, of Buck's county, of the good effects of the ashes in destroying worms and other insects, a fact strongly proved in the preceding essay. Knowing the value of this manure, he could not but see last summer with astonishment and regret, TONS of it not used, near several pot-ash manufactories in Saratoga county, New York, although it might have been had free of cost, and the lands were in great want of it: twelve and fifteen bushels of wheat having been stated to him as the common product per acre!! *Editor.*

AN ACCOUNT OF THE GROWTH, AND PROCESSES OF MEALING, MALTING, AND BREWING, OF THE NORTHERN NAKED BARLEY.*

By R. FLOWER, *Esq.*

Marden, near Hertford,
April 1, 1810.

GENTLEMEN,

WHEN I had the honour of being present at a meeting of your Society in February 1809, amongst the many subjects then discussed were the qualities and merits of the Northern naked Barley.

* From the Letters and Papers of the Bath Society, vol. xii. p. 169. Bath, 1810.

As no accurate statement was brought before you of any experiment by which its value could be ascertained, I beg leave to recommend to your attention the following account of the growth and processes of Mealing, Malting, and Brewing of the Northern naked Barley.

On the 12th of May 1809, I sowed five acres of it after a mixed crop of turnips and cabbages, which were fed off by sheep in the latter end of April and the first week in May. This crop being very abundant, kept the sheep longer on the ground, which was on this account in some degree better manured than any other land.

Although this barley was so late sown, it was ready to cut a week sooner than my English barley, and came to maturity a month sooner, which is doubtless an advantage to the husbandman, as the crop of barley on the latest-fed turnip land often suffers.

Of the produce I can only speak comparatively, as it was not large; a long drought in the summer burnt our light-land crops, and this suffered with the rest. I had but two quarters of English barley per acre; of the naked four quarters one bushel. It came up well, and had a luxuriant appearance during the dry season.

I sent a bushel of each sort of barley to a neighbouring mill, requesting each might be ground and dressed into one sort of flour; the bran only being taken out; and an accurate account of the weight of each sent to me, which was as under:

	Pecks.	lbs.		lbs.
Foreign—Flour	2	8	or	36
Bran	1	3		17
		Total		53 when returned from the mill.

	Pecks.	lbs.		lbs.
English—Flour	1	10	or	24
Bran	1	6		20
		Total		44 when returned from the mill.

Each bushel of barley lost 4 lbs. in the process of its manufacture. It will be observed that the foreign barley made 12 lbs. more of flour per bushel than the English, which is within 2 lbs. of seven pecks per quarter; and at the computed value of 2s. 6d. per peck, amounts to 17s. 6d. worth of flour more per quarter than was obtained from English barley of the last year's growth.

In the course of the winter I malted six quarters; it worked but indifferently on the floors, having many hard corn amongst it; but this I consider as the defect of almost all the barley of the year 1809. Its swell in the cistern was much greater than English barley, being from six quarters equal to our usual steeping of twenty quarters. I had also a large increase in the making, having nearly two bushels in six quarters, which is much more than it is usual to obtain from the best barley on our plan of making malt.

On brewing this malt, I had the satisfaction to find the wort tasted much richer than that brewed from my English malt.* My instrument (Richardson's Saccharometer) confirmed my observation, having extracted 12 lbs. more of saccharine matter per quarter than from the English malt.

The result of these different experiments appears to be in favour of the Northern naked Barley as follows:

	s.	d.
Nearly seven pecks of flour per quarter more than obtained from English barley, at 2*s*. 6*d*. per peck,	17	6
In its malted state, 12 lbs. more of saccharine matter per quarter extracted than from English malt, at 1*s*. 6*d*. per lb., ...	18	0

From this account it may be fairly presumed, that the Northern naked Barley is worth from 17*s* to. 18*s*.† more than the English, for the purposes of mealing, malting, and brewing.

I remain your obedient servant,

RICHARD FLOWER.

* Mr. Flower has since informed the secretary that the beer proves excellent.

† Per quarter of 8 bushels is meant. *Editor.*

REMARKS.

Mr. Vancouver confirms the fact of naked barley malting well, but adds that the grains must not be ground, but only cracked.*

A naked barley was introduced into Philadelphia a few years since, which yielded well, but upon the supposition that it would not malt, it has been but little cultivated of late. The foregoing accurate statement, however, not only fully proves the incorrectness of the opinion, but demonstrates the superiority of the naked barley for the purpose. *Editor.*

CATTLE SHOW.

THE eighth show and fair, held under the patronage of the Pennsylvania Society for improving the breed of Cattle, took place on Thursday and Friday, the 5th and 6th days of November last, at their establishment, BUSH HILL.

The following stock were exhibited on the first day:

1. By Joseph Burns, Esq. of New Castle county, Delaware, four fat steers, one of which was raised by himself, and supposed to weigh 1,400 cwt. alive

2. By James Caldwell, Esq. two full blooded Merino rams, three and four years old, raised by himself, and thorough bred; for very little if any difference, could be perceived in the quality of the wool on the rumps, thighs, and the neck or sides. Both were of a large size.

3. By Mr. James Clark, of Philadelphia county, two ewes and four lambs of the new Leicester breed, and one ram lamb: they exhibited all the characters of that incomparable breed, which with the Merino and Tunis breeds, will assist in effecting the revolution so essentially necessary, as far as respects form, disposition to fatten, and quality and quantity of wool, in the general

* Agricultural Survey of Hampshire. London, 1811. p. 160.

mass of the sheep of the United States. Three were sold for \$70.

4. By Mr. Muller, several Merino sheep.

5. By Mr. L. Seckle, six steers, and Mr. David Seckle, 10 ditto: the average weight was from 750 to 900 lbs. the 4 qrs. These cattle were a practical illustration of the principles directed to be attended to in the choice of stock, by the Society in their address, published last spring, and formed the ground work of a lesson which every young farmer or grazier would have profited by attending to. Their forms were good, the offal comparatively trifling, and with only one summer grazing, were in capital condition. They had been already sold, and having been since brought to the shambles, proved by the abundance of fat, and its general diffusion through the flesh, the richness of the grass with which they had been nourished, and the regularity of its supply.

6. By Mr. Jervis Mudge, seventy-six store cattle from Onondago county, state of New York.

7. By Miller and Cooper, 126 fat sheep and 58 store sheep.

8. By Messrs. Samuel Richards and Joseph Hart, two promising colts, by Mr. Badger's celebrated horse Hickory.

Second day.

1. By Mr. John Hastings, of Middletown township, Delaware county, 17 sheep,—full blood, and $\frac{3}{4}$ Merino rams.

2. By Mr. Dubs, thirty head of store cattle.

3. By Mr. B. Shotwell, Sussex county, New Jersey, two twin oxen, rising 8 years. These unfortunately were of that unprofitable make, which the experienced grazier will always avoid purchasing; and Philadelphia is the last market to which such animals should be brought with a view to sale. The difference between feeding cattle of desirable forms, such as come up to, or approach to that described by the Society in their address, before mentioned, is so great, and so well known that those of the contrary description, whatever be their sizes, (and the larger the more unprofitable) are always avoided. Happily the kind

alluded to, and for which, tradition says, we are indebted to England, whence they were imported previously to the great improvement of their stock, are now seldom seen.

LARGE HOGS.

THE following is a correct account of the large hogs, whose weights and dimensions were given at p. 61, of vol. 2d, of the Archives:

	Feet.	Inches.
From end of nose to root of the tail, .	8	4
Round the midlde of the body, . . .	7	4
Round the neck close behind the ears, .	4	9
Height, ...	3	10
Weight when dressed, . 834 lbs.		
Leaf fat, ... 80		

He was four years and 10 months old: and raised by Isaac Wheaton, Cumberland county, New Jersey. This hog was one of a litter of eleven, three of which died before they reached the age of 18 months: the other seven averaged 300 lbs. before they were 18 months. The dam weighed 300 lbs.; the sire when dressed weighed 785 lbs.

In December, 1809, four hogs, raised and fed by Ellis Wright, of Burlington, New Jersey, were shown in Philadelphia, of the following weights and dimensions:

1	weighed	791 lbs.
1	.	770
1	.	742
1	.	728

	Feet.	Inches.
Height of the largest, ...	3	8
Length from the snout to the root of the tail,	9	6
Girth round the body, ...	8	8

The others were nearly of the same sizes. They were part of a litter of 18, of the English and Guinea breeds. Four or five, killed at eleven months old, weighed nearly 400 lbs. The sow when fat weighed 250 lbs. The boar was small—another proof, in addition to those before adduced, of the great influence of the size of the female on the size of the progeny. The above hogs were clean looking animals, almost white, and without that slouch look that large hogs commonly have.

Benjamin Hamlen, of Tiverton, Rhode Island, killed a hog in August, 1810, that weighed when dressed 725 lbs. The animal was 2 years 6 months old.

PAPERS ON THE USEFUL ARTS.

TOOLS TO ANSWER THE PURPOSE OF FILES AND OTHER INSTRUMENTS, FOR VARIOUS USES, MADE OF STONE-WARE. BY G. CUMBERLAND, ESQ.*

TO MR. NICHOLSON.

SIR,

TO some men, but not to you, will it appear a trifle, because very obvious on reflection, to have applied so soft a substance as clay to the purpose of lograting the hardest bodies; neither should I perhaps have ever thought of such an application in the form I now use it, had I not found, in shaping some substances, that the wear of my steel files was rather expensive.

It then first occurred to me, in ranging in thought after a remedy, that, as our stone-ware is so hard as to blunt our files, files might be as well made of our stone-ware This was about two years ago, and the first use I made of the suggestion was, to fold up in muslin, cambrick, and Irish linen, separate pieces of wet clay, forcing them by the pressure of the hand into the interstices of the threads, so as on divesting them of the covering to receive a correct mould. These I had well baked, and immediately found I had procured an intire new species of file, capable even of destroying steel; and very useful indeed in cutting glass, polishing, and rasping wood, ivory, and all sorts of metals.

The ease with which I had accomplished my purpose, as is too often the case, made me content myself with the use of my own discovery, or at most giving away a few specimens as files for ladies nails of peculiar delicacy: but having since reflected, that in glass grinding (the stones for which come from the North, and are very expensive) in flatting metallic mirrors, laying mezzotinto grounds, and a number of operations that require unexpensive friction, these stone-ware graters, if I may so call them, as not being of the exact shape of files, may ultimately become very

* From Nicholson's Philos. Mag. vol. 25. p. 257. April, 1810.

useful. I take a pleasure in furnishing you with a description of my method of applying this substance, accompanied with a specimen or two of a portable size, that you may the better be able to judge of their value to the arts, which to me, the more I reflect on them, seem the more important; as in all operations of grinding a great deal of manual labour must first be bestowed on the tool, whereas here we may mould ours in an instant, if we use a press, as in pipe making, and the expense is infinitely inferior to that incurred in constructing even the cheapest file or lograter.

I am, Sir,

Your most obedient humble servant,

Bristol, Feb. 10th, 1809. G. CUMBERLAND.

P. S. I have not yet tried it, not having the means just now at hand, but if a good parabolic reflector were to be impressed with a mass of stone-ware clay covered with muslin, so as to make several casts of different degrees of fineness, we might this way acquire tools, that would greatly lessen the expense of the operation of grinding; but much would depend on care in baking. Our stone ware warps but little ever.

ANNOTATION.—by Mr. Nicholson.

This ingenious invention promises to be of considerable use in the arts. The abrasion of surfaces is performed either by a toothed tool, as in filing, rasping, &c.; or by a grinder, in which cutting or hard particles are bedded with considerable firmness in a softer mass; or by scowering, polishing, &c., in which hard particles are more or less slightly retained in a soft or tenacious substance. Mr. Cumberland's instruments appear to promise great utility in the first and last of these processes; that is, they may be used either with or without a fretting powder. There are however many objections to their being used to grind speculums; not only with regard to the intended figure, but the nature of the material.

ON FREEZING WATER IN VACUO.

The following are the passages referred to by Mr. Oliver Evans, in p. 97. of the Archives, as proving the fact of his having anticipated professor Leslie in the discovery of the possibility of freezing water in vacuo. *Editor.*

WATER boils in vacuo at the temperature of 70° and vapour may by compression be reduced to the fluid from whence it arose; hence we may infer, that water will keep cooler in vacuo than when exposed to the pressure of the atmosphere. *If an open glass vessel be filled with ether and set in warm, in vacuo, the ether will boil rapidly, and rob the water of its latent heat until it freezes.* It is not right to say that the ether becomes so cold that it freezes the water around it: the heat in the water enters the ether, causing it to boil and the ether is converted into vapour, carrying off the heat to fill the vacuum. This is a positive proof that a vacuum will receive and retain, in a latent state, more heat than a plenum.

These principles may probably be applicable to useful purposes. For instance, to cool wholesome water, such as that of the Mississippi, rendering it palatable for drinking, to supply the city of New-Orleans; or of the Schuylkill to supply the citizens of Philadelphia. A steam engine may work a large air-pump, leaving a perfect vacuum behind it on the surface of the water at every stroke. If ether be used as a medium for conducting the heat from the water into the vacuum, the pump may force the vapour rising from the ether, into another pump to be employed to compress it into a vessel immersed in water; the heat will escape into the surrounding water, and the vapour return to ether again; which being let into the vessel in the vacuum, it may thus be used over and over repeatedly. *Thus it appears possible to extract the latent heat from cold water, and apply it to boil other water; and to make ice in large quantities in hot countries by the power of a steam engine.* I suggest these ideas merely for the consideration of those who may be disposed to investigate the principles, or wish them put in operation. And,

lest, I should be thought extravagant, as was the case with the Marquis of Worcester, I give a

Description of the machine.

Make an air-pump and close the lower end of the cylinder by connecting it with a globular glass vessel, if metal will not answer as well; fix the lower end of the cylinder of this pump, so that the glass vessel shall be immersed in the water that is to be cooled, and which is to be contained in a tight vessel. Near to this pump fix another much smaller, called the condensing pump, and connect it with a small vessel, called the condenser, immersed in water, fixing a valve between them. Connect the upper end of these working cylinders by a pipe with a valve therein at the top of the exhausting pump, and connect the bottom of the condenser with the glass globe, by a small pipe, in which insert a cock, called the ether-cock. The piston rods of the pumps must work through stuffing boxes made air-tight, and each piston must have a valve fixed in it, one to shut downward and the other upward: work these pistons by a lever that is to be put in motion by a steam engine or any other power.

The operation.

Fill the glass globe with ether, so that the piston will touch its surface at every stroke; expel the air from the pumps and condenser, making a complete vacuum in them. Set the machine in motion, and every time the piston rises the exhausting piston leaves a perfect vacuum behind it: the ether then begins to boil and carry off the latent heat from the water; the steam of the ether fills the vacuum, which is again exhausted by the pump, and driven into the condensing pump which compresses it in the condenser, forcing out the heat which robs the vapour of its essential constituent part, and reduces it to ether again; the ether-cock being opened just sufficient to let the ether return to the glass globe to undergo the same operation; and so on, ad infinitum. The machine might be simplified by connecting the top of the exhausting cylinder with the condenser, dispensing with the

condensing cylinder and piston. The condensation might be sufficiently effected by the exhausting cylinder and piston alone forcing the vapour into the condenser. If the air be not expelled it will be forced into the condenser, and remain above the ether formed there without injuring the working or the effect of the engine: but I presume the condensing pump would be necessary to carry the principle to such extent as to boil water by the heat extracted from cold water. A small pump may be fixed so as to be worked by the same lever, to extract the water from the vessel as fast as necessary after it is cooled. The vessel may be kept full by the pressure of the atmosphere forcing the water through a valve at the bottom.

LAW DECISION ON A PATENT RIGHT.

ON the 5th October, 1812, before his honour Judge Livingston, in the Circuit Court of the United States, at New York, came on to trial the cause of TRYON *vs.* MOREY. The attention of patentees and patent breakers, was considerably excited by this cause, and its result has given to the latter just cause of alarm. This was an action brought by a Mr. Isaac Tryon, of Glassenbury, in Connecticut, against Luther Morey of New York, for the breach of a Patent Right secured to the said Tryon, by the United States, for the manufactory of Combs. It appeared on the trial that he originally invented the Machine while a member of our revolution army, and that it was of great service in furnishing Combs to his fellow Soldiers—but from inability to defray the expenses he was prevented from procuring a patent until some years afterwards. In the mean time a description of his Machine was carried to England and there published in a number of scientific works, as an English invention—The Defendant therefore, believing, or pretending to believe, that it was not the invention of the patentee, had, for a considerable length of time, used the Machine, relying principally as the ground of his defence, on the circumstances of the description of

the machine published in England, being dated some time previous to the issuing of the plaintiff's patent. The jury, however, on the fullest evidence, decided that the patentee was the original inventor, and that he had sustained damage for 15 months' use of the same, in the sum of $500; which, being trebled by the statute, gave the plaintiff $1500.

VARNISH FOR COLOURED DRAWINGS AND PRINTS, SO AS TO MAKE THEM RESEMBLE PAINTINGS IN OIL.

From the Monthly Magazine, London, May, 1810.

TAKE of Canada Balsam, one ounce; Spirit of Turpentine two ounces; mix them. Before this composition is applied, the drawing or print should be sized with a solution of isinglass in water; and when dry, apply the varnish with a camel's hair brush.

A LIST OF THE NAMES OF PERSONS TO WHOM PATENTS HAVE BEEN ISSUED, FROM THE TWENTY-EIGHTH OF DECEMBER, 1810, TO THE FIRST OF JANUARY, 1812.

(Continued from p. 200.)

Inventions in 1811.

Jacob Decker, of Green, Shenango county, New York, in stills and boilers, September 2.

Stephen Strong, of Wilks township, Gallia county, Ohio, a drying house for drying fruit, &c., September 2.

Abraham Howard Quincy, of Boston, in manufacturing inkstands of stone, September 3.

Joseph Atkinson, of Amherst, Massachusetts, a water wheel, September 5.

Nicholas Turbutt, of Frederick-town, Maryland, in the common plough, September 7.

Luther Holland, of Belehuston, Hampshire, Massachusetts, a horizontal pump, September 10.

Daniel Read, of Brookfield, Madison county, New York, for spinning wool and cotton, &c., called the pleasant spinner, September 10.

Thomas Pratt, of Cheshire county, New Hampshire, a horizontal vibrating churn, September 12.

Henry Wittmer, of Lancaster, Pennsylvania, in stills, September 19.

Nathaniel Perry, of Boston, in looms, September 25.

James Rodgers, of Albany, New York, in propelling boats by steam, September 27.

Thomas Power, of New York, in stoves, September 27.

Ephraim Cutter, of Walpole, New Hampshire, a crank loom for weaving all kinds of cloth, September 27.

Alexander H. Avery, of Bennington, Vermont, in tanning, September 30.

Joseph H. Shepard, of Canaan, Sommerset county, Mass., a churn, October 1.

Moses Jaques and Henry Freeman, of Woodbridge, Middlesex county, New Jersey, in the press for pressing cotton, hay, &c., October 2.

William Humphreys, of Humphreysville, Newhaven, Connecticut, for drawing and spinning wool, October 4.

Josiah Beal, Ontario county, New York, a trip hammer, September 5.

Solomon Thayer, Braintree, Norfolk county, Mass., a pendulum mill, October 9.

Ernst Gehbe, of North hampton county, Penn., for cutting files, October 10.

Charles W. Sellers, of Alexandria, Columbia District, in manufacturing fine salt from coarse, October 11.

William Harper, of Richmond, Virginia, for breaking, swingling, and beating hemp and flax, October 15.

Jonathan Sizer, of New London, New London county, Connecticut, in circular boilers, October 15.

Jacob Pierson, of Knoxville, Knox county, Tennessee, a wooden screw press for packing cotton wool, &c., October 17.

John Vernon, of Baltimore, in cutting and manufacturing boot legs, October 21.

Archibald Tanner, of Trumbull county, Ohio, in breaking and swingling hemp and flax, October 24.

Peter Sternberg, of Montgomery county, New York, improvement in his patent fire place, October 28.

Samuel Wetherill, jun. of Philadelphia, in the mode of washing white lead, October 29.

Do. of do., in setting the beds or stacks (by admission of air) in making white lead, (a) October 29.

Do. of do., in screening and separating *in water* the corroded parts of lead from the uncorroded parts, in the process of making white lead, November 1.

Do. of do., a machine for separating the oxidated from the metallic lead, in the process of manufacturing red lead, and of the manner of using the machine, November 1.

Elisha Mack, of Sheffield, Massachusetts, a water wheel, November 2.

Lebbeus Larrabee, of Nantucket, Massachusetts, in casting metallic boxes or centres of shieves or trundles for pulleys, November 4.

Jonathan Sizer, of New London, New London county, Connecticut, a machine for basoning, hardening, and steaming hats, November 6.

Anthony Butler, of Vermont, a machine for boring posts, November 7.

Benjamin Bell, of Boston, in the process of making sulphuric acid, November 7.

William Presley Claiborne, of King William county, Virginia, for cutting wheat and other small grain, November 8.

William Maher, of Rome, Oneida county, New York, a balance water gate, November 12.

(a) The patentee carries on an extensive manufactory of white lead in Philadelphia. The painters say that the article made is equal to any imported. *Editor.*

[*To be continued in the next number.*]